LAKE CLASSIFICATION REPORT FOR

EASTON LAKE, ADAMS COUNTY, WI

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EASTON LAKE
LAKE CLASSIFICATION REPORT

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Background Information about Easton Lake

Easton Lake is a 24.1-acre impoundment (man-made lake) located in the Town of Easton, Adams County, in the Central Sand Plains Area of Wisconsin. As an impoundment of Campbell Creek, it has both an inlet and outlet. Easton Lake is managed by the Easton Lake District, which formed in 1978. There is a public boat ramp on the north end of the lake owned by the Adams County Park District. The dam is owned and maintained by Adams County. A dam was first installed here in 1855 for a grist mill.

The primary soil type in both the surface and ground watersheds is sand. There are also pockets of loamy sand, muck, sandy loam, and silt loam. Sandy soil tends to be excessively drained, no matter what the slope. Water, air and nutrients move through sandy soils at a rapid rate, so that little runoff occurs unless the soil becomes saturated. Although water erosion can be a problem, wind erosion may be more of a hazard with sandy soils, especially since these soils dry out so quickly. There are also drought hazards with sandy soils. Getting vegetation started in sandy soils is often difficult due to the low available water capacity, as well as low natural fertility and organic material. Onsite waste disposal in sandy soils is also a problem because of slope and seepage; mound systems are usually required.

Land Use in Easton Lake Watersheds

Although the surface watershed for Easton Lake is fairly small, it has a very large ground watershed in comparison to the size of the lake. The lake receives significant input of materials from the large upper watershed. In the surface watershed, the main two land use types are Non-Irrigated and Irrigated Agriculture. The top two land uses in the ground watershed are Woodlands and Irrigated Agriculture.

Easton Lake has a total shoreline of 2.11 miles (11,140.8 feet). Much of the lake shore is in residential use. Most of the areas near the shores are steeply sloped, except at the far northwest end, where the land is flatter. Several buildings along the shore are located very near the water line. Additionally, much of the shore has active erosion that is likely to be negatively impacting the water quality of the lake.

A shore survey was done on Easton Lake during the summer of 2004. At that time, native vegetation covered most of Easton Lake's shoreline. However, a significant amount of the shore revealed active erosion. The 2004 inventory included classifying areas of the Easton Lake shorelines as having "adequate" or "inadequate" buffers. An “adequate” buffer was defined as one having the first 35 feet landward covered by native vegetation. An “inadequate” buffer was anything that didn’t meet the definition of “adequate buffer”, including native vegetation strips less than 35 feet landward. Using these definitions, only 58.16% (6479.59 feet) of Easton Lake’s shoreline had an “adequate buffer” in 2004, leaving 41.84% (4661.31 feet) as “inadequate.” Most of the “inadequate” buffer areas were found with mowed lawns and/or insufficient.

Adequate buffers on Easton Lake in some places could be easily installed on the inadequate areas by either letting the first 35 feet landward from the water just grow without mowing it, except for a path to the water, or by planting native seedlings sufficient to fill in the first 35 feet or using biologs to protect the shore that are vegetated. Where areas are deeply eroded, shaping, revegetating and protecting the shores will be necessary to prevent further erosion.

Water Testing Results

Between 2004 and 2006, Adams County Land & Water Conservation Department gathered water chemistry and other water quality information for Easton Lake. Part of the information was gained from periodic water sampling done by Adams County LWCD. Historic information about water testing on Easton Lake was also obtained from the testing done in relation to the two reports discussed earlier in this report.

Measuring the phosphorus in a lake system provides an indication of the nutrient level in a lake. Increased phosphorus in a lake will feed algal blooms and also may cause excess plant growth. The 2004-2006 summer average phosphorus concentration in Easton Lake was 53.3 micrograms/liter. This average is considerably above the 30 micrograms/liter level recommended to avoid nuisance algal blooms. This concentration suggests that Easton Lake is likely to have nuisance algal blooms from excessive phosphorus.

Water clarity is a critical factor for plants. If plants don’t get more than 2% of the surface illumination, they won’t survive. Water clarity is measured with a Secchi disk. Average summer Secchi disk clarity in Easton Lake in 2004-2006 was 7.8 feet. This is good water clarity.

Chlorophyll-a concentration provides a measurement of the amount of algae in a lake’s water. Algae are natural and essential in lakes, but high algal populations can increase water turbidity and reduce light available for plant growth, as well as result in unpleasing odor and appearance. The 2004-2006 growing season (June-September) average chlorophyll-a concentration in Easton Lake was 17.2 micrograms/liter, a fairly low algal concentration for an impoundment.

Easton Lake water testing results showed "hard" water with an average of 145 milligrams/liter CaCO3. Hard water lakes tend to produce more fish and aquatic plants than soft water lakes because they are often located in watersheds with soils that load phosphorus into the lake water.

A lake with a neutral or slightly alkaline pH like Easton Lake is a good lake for fish and plant survival. Natural rainfall in Wisconsin averages a pH of 5.6. This means that if the rain falls on a lake without sufficient alkalinity to buffer that acid water coming in by rainfall, the lake's fish cannot reproduce. That is not a problem at Easton Lake, since its surface water alkalinity averages 103 milliequivalents/liter. The pH levels from the bottom of the lake to the surface hovered between nearly 7 and 8, alkaline enough to buffer acid rain.

Most of the other water quality testing at Easton Lake showed no areas of concern. The average calcium level in Easton Lake's water during the testing period was 28.23 milligrams/liter. The average Magnesium level was 13.84 milligrams/liter. Both of these are low-level readings. Both sodium and potassium levels in Easton Lake are very low: the average sodium level was 2.05 milligrams/liter; the average potassium reading was 0.74 milligrams/liter.

To prevent the formation of hydrogen sulfate gas, levels of 10 milligrams/liter are best. A health advisory kicks in at 30 milligrams/liter. Sulfate levels in Easton Lake are 12.13 milligrams/liter, above the level for formation of hydrogen sulfate, but below the health advisory level. Turbidity reflects water clarity. The term refers to suspended solids in the water column—solids that may include clay, silt, sand, plankton, waste, sewage and other pollutants. Very turbid waters may not only smell and mask bacteria & other pollutants, but also tend to be aesthetically displeasing, thus curtailing recreational uses of the water. Turbidity levels for Easton Lake were at low levels between 2004-2006.

Some water testing results indicated a need to continue monitoring the nutrients to make sure no problems are developing. The presence of a significant amount of chloride over a period of time may indicate that there are negative human impacts on the water quality present from septic system failure, the presence of fertilizer and/or waste, deposition of road-salt, and other nutrients. Chloride levels found in Easton Lake during the testing period averaged 4.2 milligrams/liter, considerably over the natural level of 3 milligrams/liter for this region of Wisconsin. This issue needs to be further investigated to see if the high chloride readings are indicative of some other problem.

Nitrogen levels can affect other aspects of water quality. The sum of water testing results for nitrate, nitrite and ammonium levels of over .3 milligrams/liter in the spring can be used to project the likelihood of an algal bloom in the summer (assuming sufficient phosphorus is also present). Easton Lake's combination spring levels from 2004 to 2006 average 2.83 milligrams/liter, considerably above the .3 milligrams/liter predictive level. This could be a problem because the growth level of Eurasian watermilfoil, one of the invasive aquatic plant species in Easton Lake, has been correlated with fertilization of lake sediments by nitrogen-rich runoff. Further, with such elevated nitrogen, some of the algal blooms in the lake may be at least partly nitrogen-related.

Phosphorus

Like most lakes in Wisconsin, Easton Lake is a phosphorus-limited lake: of the pollutants that end up in the lake, the one that most affects the overall quality of the lake water is phosphorus. The amount of phosphorus especially affects the frequency and density of aquatic vegetation and the frequency and density of various kinds of algae, as well as water clarity and other water quality aspects.

The total phosphorus (TP) concentration in a lake is considered a good indicator of a lake's nutrient status, since the TP concentration tends to be more stable than other types of phosphorus concentration. For a man-made lake like Easton Lake, a total phosphorus concentration below 30 micrograms/liter tends to result in few nuisance algal blooms. Easton Lake's growing season (June-September) surface average total phosphorus level of 53.3 micrograms/liter is over that limit, suggesting that phosphorus-related nuisance algal blooms may occur.

Land use plays a major role in phosphorus loading. Currently, the most phosphorus loading is coming from agriculture in the surface, with a smaller portion coming from the ground watershed. Some phosphorus deposition cannot be controlled by humans. However, some phosphorus (and other nutrient) input can be decreased or increased by changes in human land use patterns. Practices such as shoreland buffer restoration along waterways; infiltrating stormwater runoff from roof tops, driveways and other impervious surfaces; using no phosphorus lawn fertilizers; and reducing phosphorus input to and properly managing septic systems will minimize phosphorus inputs into the lake. Such practices need to be implemented in all of the Easton Creek Watershed in order for a significant impact on phosphorus reduction to occur.

Reducing the amount of input from the surface and ground watersheds results in less nutrient loading into the lake itself. Under the modeling predictions, reducing phosphorus inputs from human-based activities even 10% would improve Easton Lake water quality by 1.5 to 12.4 micrograms. A 25% reduction would save 5.5 to 30.9 micrograms/liter. A 25% reduction could reduce the likelihood of nuisance algal blooms substantially. These predictions make it clear that reducing current phosphorus inputs to the lake are essential to improve, maintain and protect Easton Lake's health for future generations.

Aquatic Plant Community

Based on water clarity, chlorophyll and phosphorus data, Easton Lake is an eutrophic to mesotrophic seepage lake with fair to good water clarity and fair water quality. This trophic state should support fairly dense plant growth and frequent algal blooms. Sufficient nutrients, good water clarity, shallow lake, and soft sediments at Easton Lake favor plant growth. The aquatic plant community in Easton Lake is in the category of those very tolerant of disturbance, probably due to selection by a series of past disturbances. The plant community in Easton Lake is farther from an undisturbed condition than the average lake in Wisconsin overall and in the North Central Hardwood Region. In other words, the aquatic plant community in Easton Lake has been impacted by an above average amount of disturbance and tolerates higher than average disturbance. Disturbances include invasions of exotic species, boat traffic, shoreline development, harvesting and past herbicide treatments.

Of the 21 species found in Easton Lake, 18 were native and 3 were exotic invasives. In the native plant category, 8 were emergent, 3 were free-floating plants, and 7 were submergent types. Three exotic invasives, *Myriophyllum spicatum* (Eurasian Watermilfoil), *Phalaris arundinacea* (Reed Canarygrass) and *Potamogeton crispus* (Curly-Leaf Pondweed) were found.

Aquatic plants occurred at 100% of the sample sites in Easton Lake to a maximum rooting depth of 11'. Free-floating plants were found in all four depth zones. The 0-1.5 feet (Zone 1) depth zone produced the most frequently occurring plant growth and highest density. *Wolffia columbiana* was the densest and most frequently-occurring plant in Easton Lake in 2006 followed by *Elodea canadensis*, *Lemna minor* and *Ceratophyllum demersum.* No other species reached a frequency of 50% or greater. *Wolffia columbiana*, *Elodea canadensis* and *Lemna minor* occurred at more than average density overall in the lake in summer 2006.

Wolffia columbiana was also the dominant aquatic plant species in Easton Lake. Sub-dominant were *Lemna minor*, *Elodea canadensis,* and *Certatophyllum demersum,* in that order. *Myriophyllum spicatum, Potamogeton crispus* and *Phalaris arundinacea*, the exotics found Easton Lake, were not present in high frequency, high density or high dominance. It is possible that *Potamogeton crispus* is under-represented, since this survey was performed in August, somewhat later than its peak season.

Fish/Wildlife/Endangered Resources

A 1954 fishery inventory of Easton Lake found that brown trout, white suckers, golden shiners and bullheads were scarce in the lake, but bluegill and black crappie were abundant or common. A few northern pike were also found. An inventory in the 1960s found the same kind of fish, plus pumpkinseeds and blacknose shiners. Stocking of bullheads was done in the 1930s and 1940s. Reviews found on Lake-Link (online) in 2001 and 2005 described the lake as having “monster bass” and “huge panfish”.

The Easton Lake watersheds (ground and surface) have several endangered natural communities, as well as plants and a lizard of concern. Natural communities found there include Alder Thicket, Calcareous Fen, Dry Prairie, Northern Sedge Meadow, Northern Wet Forest, Shrub-Carr and Stream (hard, fast, cold). The amphibian of concern is the Western Slender Glass Lizard (*Ophisaurus attenuatus*). Special plants found include Bushy Aster (*Aster dumosus*), Early Anemone (*Anemone nemorsa*), Hairy Beardstongue (*Penstemon hirsutus*) and Hooker’s Orchid (*Plantanthera hookeri*).

Conclusion

Easton Lake is currently an impoundment impacted substantially by its large ground watersheds and the smaller surface watershed, as well as significant disturbances. The Easton Lake District will need to regularly review and update its lake management plan in order to address the management issues in a logical, cohesive manner.

RECOMMENDATIONS

Lake Management Plan

The Easton Lake District will need to regularly review and update its lake management plan in order to address the management issues needed. The plan will need to always address the following: aquatic plant management; control/management of invasive species; wildlife and fishery management; watershed management; shoreland protection; critical habitat protection; water quality protection; inventory & management of the larger watershed.

Watershed Recommendations

With such a large ground watershed upstream and a substantial surface watershed compared to the small acreage of the lake, results of the modeling certainly suggest that input of nutrients, especially phosphorus, are factors that need to be explored for Easton Lake.

Therefore, it is recommended that both surface and ground watersheds be inventoried, documenting any of the following: runoff from any livestock operations that may be entering the surface water; soil erosion sites; agricultural producers not complying with nutrient management plans and/or irrigation water management plans. If such sites are documented, steps for dealing with these issues can be incorporated into the lake management plan as needed.

The Easton Lake District might consider approaching the WDNR or conservancy organizations to explore putting the east end of the lake, with its meandering stream and wetlands, into a conservancy or limited development area to assure that those areas won't be changed in a way that would degrade water quality of the lake.

Shoreland Recommendations

All lake residents should practice best management on their lake properties, including keeping septic systems cleaned and in proper condition, eliminating the use of lawn fertilizers, cleaning up pet wastes and not composting near the water.

Since several sites of active erosion were discovered during the various surveys, it is imperative that the eroding shores around the lake be restored and/or protected as soon as possible to reduce further sedimentation in the lake and contamination by the various attachments to eroding soil that ends up in the lake.

Aquatic Plant Management Recommendations

1) Involvement of the Lake District in water quality monitoring and invasive species monitoring through the Citizen Volunteer Lake Monitoring Program. The Lake District should also have volunteers actively involved in the Clean Boats, Clean Waters program to assist in preventing the introduction of other invasives into the lake and assist in boater education.

2) Chemical treatments for plant growth are not recommended in Easton Lake due to very small populations of invasive aquatic species, especially since:.
    a) The decaying plant material releases nutrients that feed algae growth that further reduce water clarity.

b) The decaying material also enriches the sediments at the site.
c) The herbicides are toxic to an important part of a lake food chain, the invertebrates.
d) Broad-spectrum treatments would open up areas that would be vulnerable to the spread of the exotic species.

3) Restore natural shoreline restoration. Disturbed and/or eroding shoreline covers too much of the shore.
   a) Unmowed native vegetation reduces shoreline erosion and run-off into the lake and filters the run-off that does enter the lake thus reducing nutrient inputs.
   b) Shoreline restoration could mean simply leaving a band of natural vegetation around the shore by discontinuing mowing.
   c) Restoration could be as ambitious as extensive plantings of attractive native wetland species in the water and native grasses, flowers, shrubs and trees on the near shore area.

4) Fine-tune the harvesting plan. Plan should be designed to remove nutrients, target the invasive plant areas, provide navigation and recreation where appropriate, prevent the spread of species that could become overabundant and improve habitat. <u>Regularly</u> <u>scheduled</u> harvesting of the aquatic plants will be necessary to keep aquatic plants reduced and safe navigational channels open.
   a) Nutrient reduction. Harvesting removes the nutrients found in the plant tissue and filamentous algae mats as long as the cut fragments are collected, rather than left in the lake to decay. Provide navigation and recreation where appropriate. Cutting channels through the areas that have the densest plant growth will also aid navigation of the lake.
   b) Harvesting by machine should not be done in water less than 3 feet deep. In these areas, lakefront owners can be encouraged to clear the 30 foot wide corridor permitted by the WDNR (including any dock area).
   c) Prevent the spread of species that have become overabundant by harvesting and hand removal, especially for navigational channels.
   d) Improve habitat. Cutting channels by harvesting provides edge needed for habitat and allows the predator fish to better find prey, supporting a more balanced fishery. These open areas are also used by wildlife. The 0-1.5ft depth zone supports the best species richness and diversity. The only harvesting that should be conducted in this zone are channels next to the docks for land owner access.

5) Cooperate with programs in the watershed to reduce nutrient inputs to the lake.

6) Eliminate the use of lawn fertilizers, both organic and inorganic, on properties around the lake.

LAKE CLASSIFICATION REPORT FOR EASTON LAKE, ADAMS COUNTY

INTRODUCTION

In 2003, The Adams County Land & Water Conservation Department (Adams County LWCD) determined that a significant amount of natural resource data needed to be collected on the lakes with public access in order to provide it and the public with information necessary to manage the lakes in a manner that would preserve or improve water quality and keep it appropriate for public use. In some instances, there was significant historical data about a particular lake; in that instance, the study activities concentrated on combining and updating information. In other instances, there was no information on a lake, so study activities concentrating on gathering data about that lake. Further, it was discovered that information was scattered among various citizens, so often what information was actually available regarding a particular lake was unknown. To assist in updating some information and gathering baseline information, plus centralize the data collected, so the public may access it. The Adams County LWCD received a series of grants from the Wisconsin Department of Natural Resources (WDNR) from the Lake Classification Grant Program.

Objectives of the study were:

- collect physical data on the named lakes to assist in assessing the health of Adams County lake ecosystems and in classifying the water quality of the lakes.
- collect chemical and biological data on the named lakes to assist in assessing the health of Adams County lake ecosystems and in classifying the water quality of the lakes.
- develop a library of lake information that is centrally located and accessible to the public and to City, County, State and Federal agencies.
- make specific recommendations for actions and strategies for the protection, preservation and management of the lakes and their watersheds.
- create a baseline for future lake water quality monitoring.
- provide technical information for the development of comprehensive lake management plans for each lake
- provide a basis for the water quality component of the Adams County Land and Water Resource Management Plan. Components of the plan will be incorporated into Adams County's "Smart Growth Plan".
- develop and implement educational programs and materials to inform and educate lake area property owners and lake users in Adams County.

METHODS OF DATA COLLECTION

To collect the physical data, the following methods were used:

- delineation & mapping of ground & surface watersheds using topographic maps, ground truthing and computer modeling;
- identification of flow patterns for both the surface & ground watersheds using known flow maps and topographic maps;
- inventory & mapping of current land use with orthographic photos and collected county information;
- inventory & mapping of shoreline erosion and buffers using county parcel maps and visual observation;
- inventory & mapping for historical and cultural sites using information from the local historical society and the Wisconsin Historical Society;
- identification & mapping of critical habitat areas with WDNR and Adams County LWCD staff;
- identification & mapping of endangered or threatened natural resources (including natural communities, plant & animal species) using information from the Natural Heritage Inventory of Wisconsin;
- identification & mapping of wetland areas using WDNR and Natural Resource Conservation Service wetland maps;
- preparation of soil maps for each of the lake watersheds using soil survey data from the Natural Resource Conservation Service.

To collect water quality information, different methods were used:

- for three years, lakes were sampled during late winter, at spring and fall turnover, and several times during the summer for various parameters of water quality, including dissolved oxygen, relevant to fish survival and total phosphorus, related to aquatic plant and algae growth;
- random samples from wells in each lake watershed were taken in two years and tested for several factors;
- aquatic plant surveys were done on all 20 lakes and reports prepared, including identification of exotics, identifying existing aquatic plant community, evaluation of community measures, mapping of plant distribution, and recommendations;
- all lakes were evaluated for critical habitat areas, with reports and recommendations being made to the respective lakes and the WDNR;
- lake water quality modeling was done using data collected, as well as historical data where it was available.

WATER QUALITY COMPUTER MODELING

Wisconsin developed a computer modeling program called WiLMS (Wisconsin Lake Modeling Suite) to assist in determining the amount of phosphorus being loaded annually into a lake, as well as the probable source of that phosphorus. This suite has many models, including Lake Total Phosphorus Prediction, Lake Eutrophic Analysis Procedure, Expanded Trophic Response, Summary Trophic Response, Internal Load Estimator, Prediction & Uncertainty Analysis, and Water & Nutrient Outflow. The models that various types of data inputs: known water chemistry; surface area of lake; mean depth of lake; volume of lake; land use types & acreage. This information is then used in the various models to determine the hydrologic budget, estimated residence time, flushing rate, and other parameters.

Using the data collected over the course of the studies, various models were run under the WiLMS Suite. These water quality models are computer-based mathematical models that simulate lake water quality and watershed runoff conditions. They are meant to be a tool to assist in predicting changes in water quality when watershed management activities are simulated. For example, a model might estimate how much water quality improvement would occur if watershed sources of phosphorus inputs were reduced. However, it should be understood that these models predict only a relative response, not an exact response. Modeling results will be incorporated into topic discussions as appropriate.

DISSEMINATION OF PROJECT DELIVERABLES

The results of this study will be distributed various agencies, organizations and the public as previously described. Based on the classification information, the Adams County Land and Water Conservation Department will identify assistance requests and determine the appropriate future activities, based on the classification determinations. To provide the requested assistance, Adams County Land and Water Conservation Department will incorporate the lake management plans goals, priorities and action items into its Annual Plan of Operations. Goals, priorities and action items may include educational programs, formation of lake districts, further development of lake management plans and implementation of lake management plans.

ADAMS COUNTY INFORMATION

Adams County lies in south central Wisconsin, shaped roughly like the outline of Illinois. Adams County is a small rural county with a full-time population of about 20,000. Between 1980 and 2000, Adams County's population grew by more than 20%, with most of the population increase being located upon the lakes and streams. The population increase has resulted in a greater need for facilitation, technical assistance and education, including information on the lakes and streams.

Figure 1: Adams County Location in Wisconsin

EASTON LAKE BACKGROUND INFORMATION

Easton Lake is a 24.1-acre impoundment (man-made lake) located in the Town of Easton, Adams County, in the Central Sand Plains Area of Wisconsin. As an impoundment of Campbell Creek, it has both an inlet and outlet. Easton Lake is managed by the Easton Lake District, which formed in 1978. There is a public boat ramp on the north end of the lake owned by the Adams County Park District. The dam is owned and maintained by Adams County. A dam was first installed here in 1855 for a grist mill.

Figure 2: Easton Lake location

In the late summer of 2007, a sinkhole was discovered in the road crossing over the Easton Dam. Further investigation revealed that the hole was 4 feet deep, going down into the dam. Later in 2007, it was discovered that Easton Dam was leaking due to warped boards in its gate. In the process of fixing that problem, other issues were discovered. In April 2008, a boil was discovered on the downstream side of the dam. The lake is scheduled to be drawn down in April 2008 to about the original stream level. It will stay down until repairs on the dam and other activities are carried out, perhaps as long as 2 to 3 years.

The Central Sand Plains, which contain Easton Lake, are found in the Driftless Area of Wisconsin. The area is characterized by varying elevations, with numerous, usually flat-topped ridges & hills sometimes called "mounds." Deposits made by streams from the melting ice sheet cover large areas and usually consist of sand, clay and gravel.

Bedrock and Historical Vegetation

Bedrock around Easton Lake is mostly sandstone, both weak and resistant, formed in the Cambrian Period of Geology (542 to 488 millions years ago). Bedrock may be 200 or more feet below the sand/clay/gravel deposits left by melting ice cover.

Original upland vegetation of the area included extensive wetlands of many types (including open bogs, shrub swamps & sedge meadows), as well as prairies, oak forests, savannahs and barrens. Mesic white pine & hemlock forests were found in the northwest portion of the region. Most of the historic wetlands were drained in the 1900s and used for cropping. The current forested areas are mostly oak-dominated, followed by aspen and pines. There are also small portions of maple-basswood forest and lowland hardwoods.

Soils in the Easton Lake Watersheds

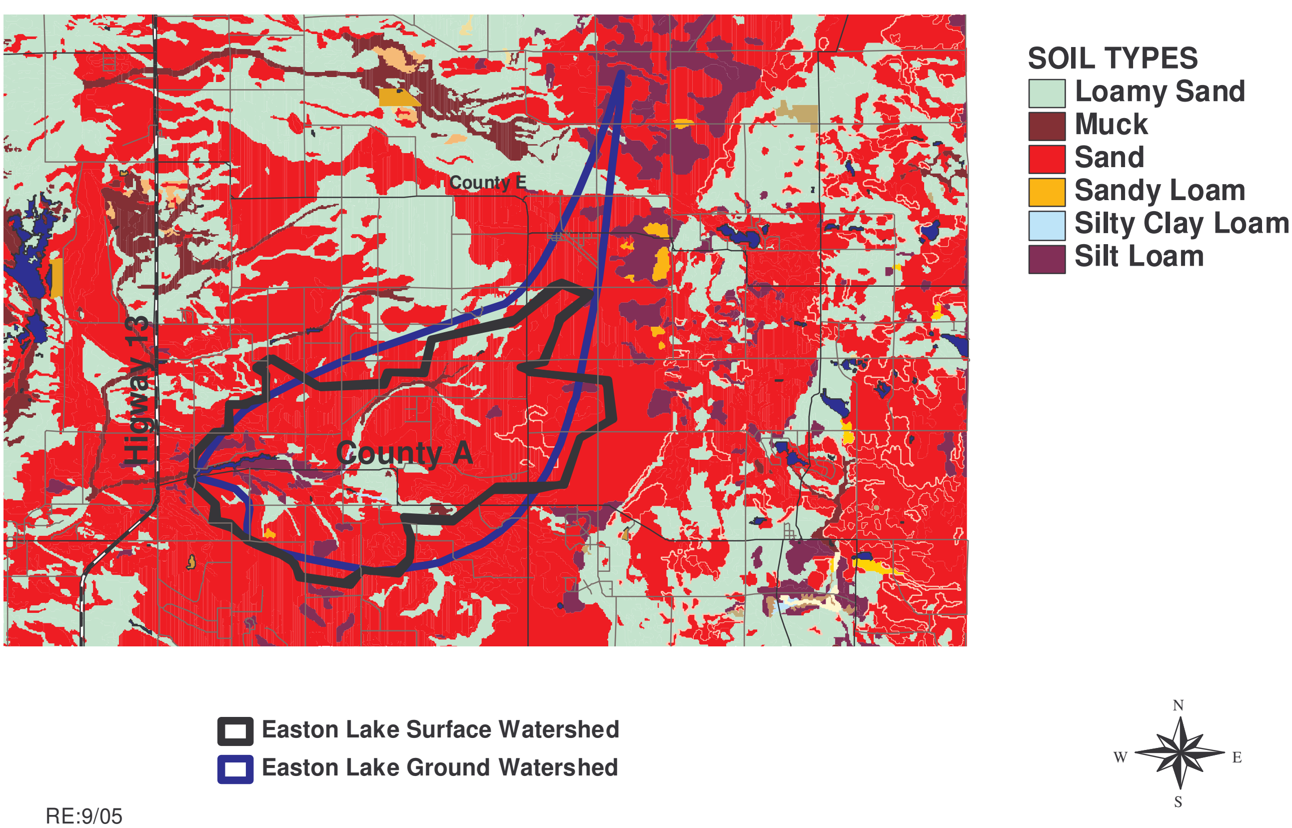
The primary soil type in both the surface and ground watersheds is sand. The second most common soil type in both watersheds is loamy sand. There are also pockets of muck, sandy loam, and silt loam.

Sandy soil tends to be excessively drained, no matter what the slope. Water, air and nutrients move through sandy soils at a rapid rate, so that little runoff occurs unless the soil becomes saturated. Although water erosion can be a problem, wind erosion may be more of a hazard with sandy soils, especially since these soils dry out so quickly. There are also draught hazards with sandy soils. Getting vegetation started in sandy soils is often difficult due to the low available water capacity, as well as low natural fertility and organic material. Onsite waste disposal in sandy soils is also a problem because of slope and seepage; mound systems are usually required.

Loamy sands tend to be well-drained, with water, air and nutrients moving through them at a rapid rate. Runoff, when it occurs, tends to be slow. Loamy sands have little water-holding capacity and low natural fertility, although they usually have more organic matter present than do sandy soils. Both wind and water erosion are potential hazards with loamy sands, as is drought. There are difficulties with waste disposal and vegetation establishment because of slope and seepage.

The soil and soil slopes around lakes and streams are very important to water quality. They affect amount of infiltration of surface precipitation into the ground and the amount of contaminants that may reach the groundwater, as well as the amount of surface stormwater runoff. In addition, these two factors affect the amount and content of pollutants and particles (including soil) that may wash into a water body, affecting its water quality, its aquatic plant community and its fishery. Further, soil types and soil slopes help determine the appropriate private sewage system and other engineering practices for a particular site, since they affect absorption, filtration and infiltration of contamination from engineering practices.

Figure 3: Easton Lake Soils



PRIOR STUDIES OF EASTON LAKE AREA

The Wisconsin Department of Natural Resources produced a report in 1983 outlining the results of its study of Easton Lake called "Easton Lake: Feasibility Study & Management Alternatives." The report noted that dense plant growth and sedimentation from erosion were long-term problems with the lake. The report indicated that watershed runoff contributed the most phosphorus to the lake, but went on to say that because of the high flushing rate of the lake, these nutrients were not the main contributor of nutrients producing the dense aquatic plant and algal growth. Instead, it attributed these two problems to the thick, nutrient-rich sediment of the lake plus the good water clarity. It estimated that there were 167,505 cubic yards of sediment in the lake. The report also indicated that its testing showed that most of the groundwater in the area flowed into the lake, except by the dam, where the flow was reversed.

The WDNR performed an aquatic plant survey as part of the field work for this report. In 1981, it found that *Elodea canadensis* (common waterweed), *Lemna minor* (lesser duckweed), *Potamogeton crispus* (curly-leaf pondweed, an invasive) and *Potamogeton praelongus* (white-stemmed pondweed) were abundant in the lake. Common plants included *Ceratophyllum demersum* (coontail), *Potamogeton pectinatus* (Sago pondweed), *Potamogeton spirillus* (spiral-fruited pondweed), *Ranunculus tricophyllus* (water crowfoot) and *Typha latifolia* (narrow-leaved cattail). The two scarce plants were both emergent plants: *Sagittaria latifolia* (arrowhead) and *Scirpus validus* (soft-stemmed bulrush). The report opined that the rapid flushing rate of the lake made using chemicals to try to control the aquatic plants impractical.

The report also cited the results of a 1975 fish survey of Easton Lake, which found that bluegills, largemouth bass, pumpkinseeds and white suckers were abundant, while golden shiners were merely common. Fish present, but scarce, included northern pike and brown trout.

This report also discussed reason that it felt a return to creek status would be appropriate for the current lake. Such a return, the report indicated, would end the long-term expense and problems with aquatic plant control; eliminate the cost of dam maintenance (which the Lake District was in the process of gaining ownership of in 1981); reinstate trout, producing increased revenue from trout fishing; and add more acreage and possible increase in property values of waterfront property there.

The results of another study were reported in a report from 2003 by Nancy Turyk and Paul McGinley of UW-Stevens Point titled "Assessment of Water Quality, Sediment, Groundwater and Tributaries of Easton Lake, Adams County, WI." It too dealt with the dense plant growth found at the lake, indicating that it was attributable to the fact that most of the phosphorus in the lake was immediately accessible to aquatic plants and algae. Both nitrogen and phosphorus, the two elements most related to aquatic plant and algal growth, were elevated in Easton Lake.

This study included surface water and groundwater quality testing. The lake was found to have moderately hard water with an alkaline average pH of 8.4. The groundwater flowed east to west, the same result as the earlier study. Water clarity was poor to fair, ranging from 7 feet to 8 feet. Although the average chlorophyll-a level was 4.6 micrograms/liter, the mid-summer readings reached as high as 18.7 micrograms/liter. The total phosphorus results ranged from 37 micrograms/liter to 157 micrograms/liter, with a higher rate coming in (156 micrograms/liter) to the lake than leaving the lake (106 micrograms/liter). Chloride readings and nitrogen readings were also elevated in the wells tested, suggesting negative land use impact on the water quality. Hypoxia (low dissolved oxygen) and even anoxia (no dissolved oxygen) plagued the lake, sometimes in the entire water column, even though the overall average for dissolved oxygen was 9.6 milligrams/liter.

The abbreviated aquatic plant study done for this report revealed that most of the aquatic plants in the lake were those most tolerant of poor water clarity and soft sediment. The dominant plant was *Elodea canadensis*. Subdominant were *Ceratophyllum demersum* and *Lemna minor*. The report noted that 39% of the lake's shoreline was disturbed. The aquatic plant community was ranked as below average.

That report made four recommendations for improving the lake's water quality:

- Reduce the surface runoff to the tributaries of Easton Lake.
- Reduce the nutrient input from septics in the area (the groundwater flows through septic fields into the lake).
- Reduce nutrient input from groundwater overall.
- Test wells for triazine and other herbicides.

CURRENT LAND USE

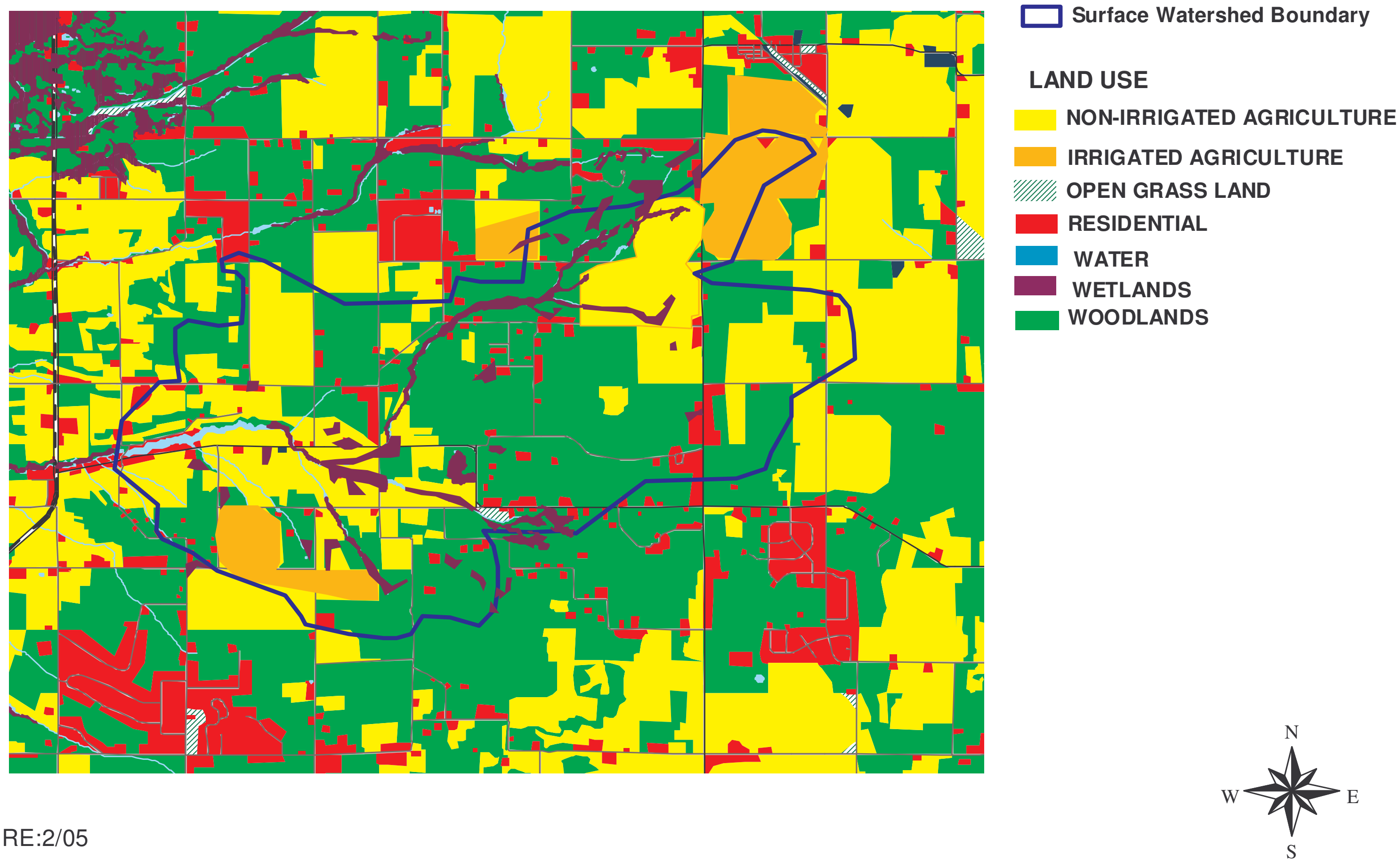
Although the surface watershed for Easton Lake is fairly small, it has a very large ground watershed in comparison to the size of the lake. The lake receives significant input of materials from the large upper watershed. In the surface watershed, the main two land use types are Non-Irrigated and Irrigated Agriculture. The top two land uses in the ground watershed are Woodlands and Irrigated Agriculture.

Figure 4: Easton Lake Watersheds Land Use in Acres and Percent of Total

	Surface		**Ground**		**Total**	
Easton Lake	Acres	% Total	Acres	% Total	Acres	% Total
Agriculture--Non Irrigated	2972.28	29.29%	525.77	16.97%	3498.05	26.28%
Agriculture--Irrigated	3133.63	30.88%	731.20	22.21%	3864.84	28.76%
Grassland/Pasture	53.78	0.53%	14.82	0.45%	68.60	0.51%
Residential	1970.70	19.42%	475.73	14.45%	2446.42	18.20%
Water	1145.68	11.29%	114.24	3.47%	1259.92	9.37%
Woodland	871.69	8.59%	1397.55	42.45%	2269.25	16.88%
total	10147.77	100.00%	3292.23	100.00%	13440	100.00%

Studies have shown that land use around a lake has a great impact on the water quality of that lake, especially in the amount and content of surface runoff. (James, T., 1992, I-10; Kibler, D.F., ed. 1982. 271) For example, while natural woodland may (on the average) absorb 3.5" out of a 4" rainfall, leaving only .5" as runoff, a residential area with quarter-acre lots may absorb only 2.3" of the 4", leaving 1.7" to run off the land into the lake—the same amount as may be expected to run off from a corn or soybean field. 1.7" of runoff translates into 46,200 gallons per acre ending up in the lake! Percentage of impervious surface, the soil type, vegetation present and slope of the site can all affect runoff volume. (Frankenberger, J, ID-230).

Easton Lake Surface Watershed Land Use



RE:2/05

Figure 5a: Land Use in Easton Lake Surface Watershed

EASTON LAKE GROUND WATERSHED LAND USE

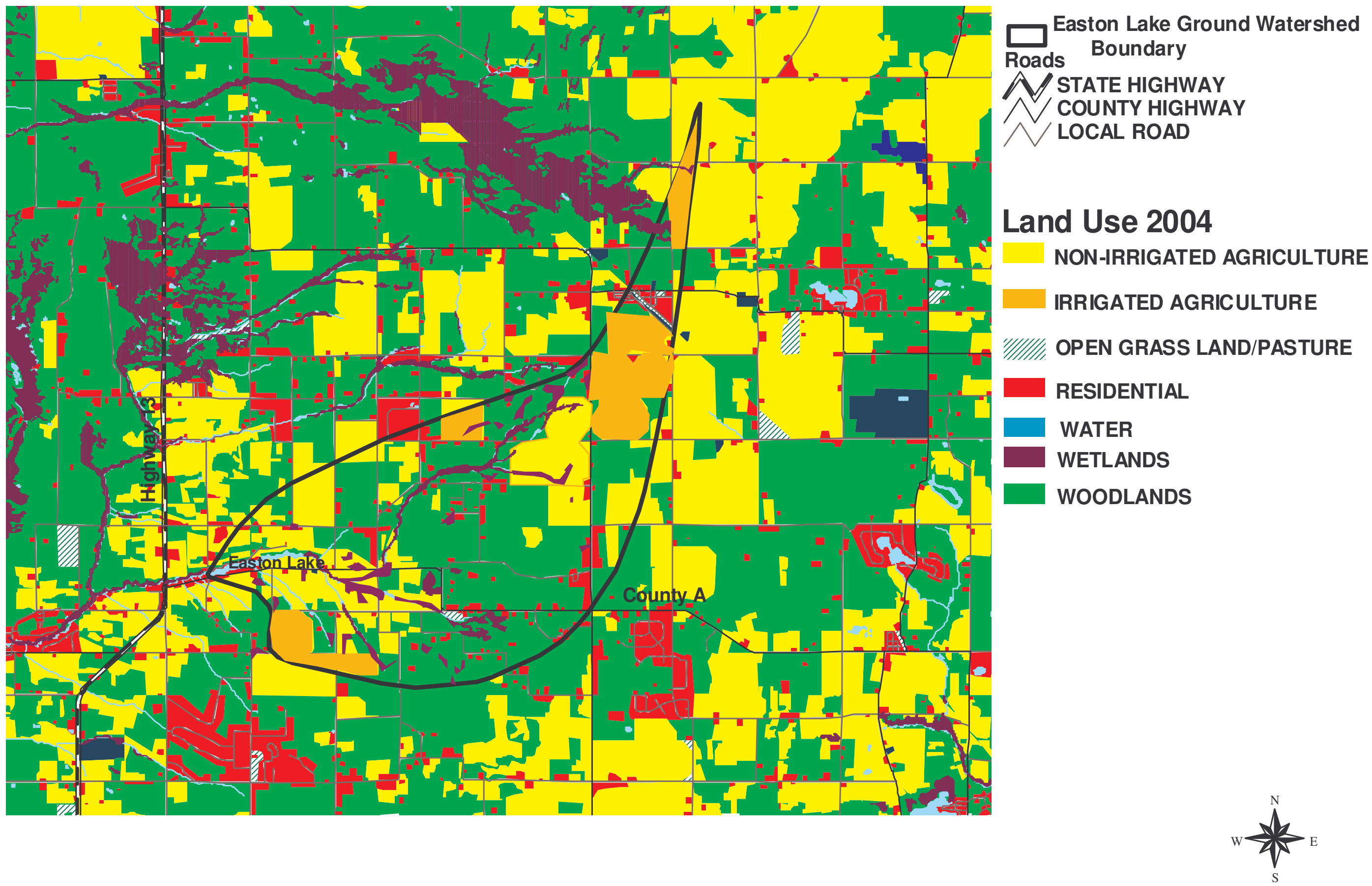


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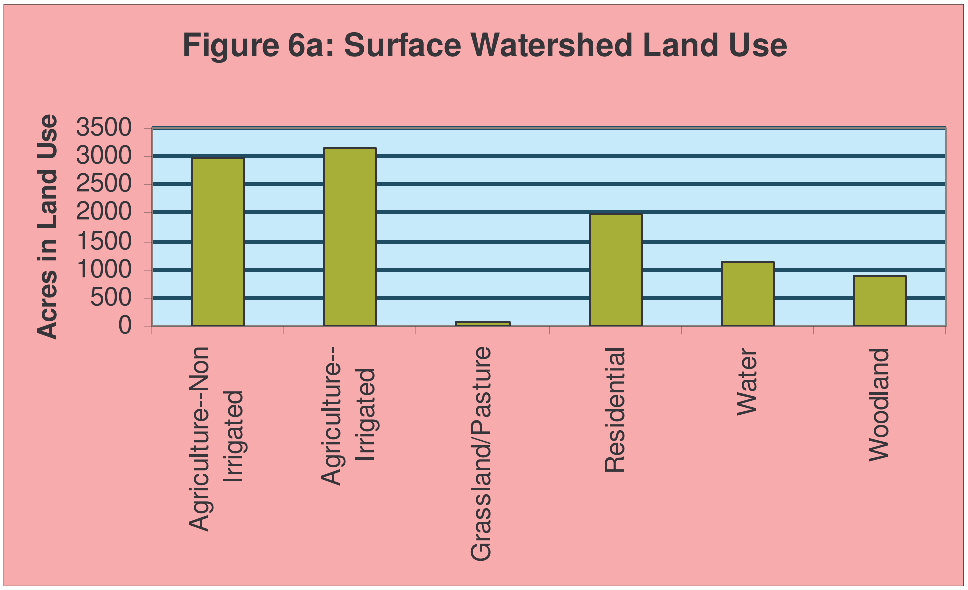
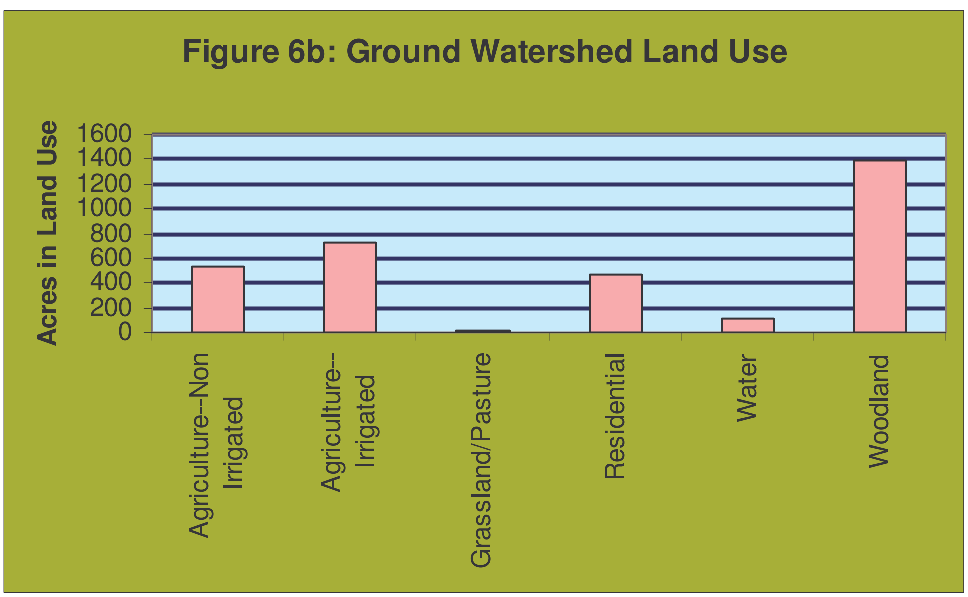
Figure 5b: Land use in Easton Lake Ground Watershed

When water runs over a surface, it picks up whatever loose pollutants—sediment, chemicals, metals, exhaust gas, etc—are present on that surface and takes those items with it into the lake. Increased development around a lake tends to increase the amount of pollutants being carried into the lake, thus negatively affecting water quality. Residential development areas with lots of one-quarter acre or less may deliver as much as 2.5 pounds of phosphorus per year to the lake for each acre of development.





There are two specific kinds of land use—wetlands and shorelands--that are so important to water quality that they will be separately discussed.

WETLANDS

A number of wetlands are located in the Easton Lake surface and ground watersheds, especially before the lake around the stream coming in (Figures 5a & 5b). In the past, wetlands were seen as "wasted land" that only encouraged disease-transmitting insects. Many wetlands were drained and filled in for cropping, pasturing, or even residential development. In the last few decades, however, the importance of wetlands has become evident, even as wetlands continue to decline in acreage.

Wetlands play an important role in maintaining water quality by trapping many pollutants in runoff and flood waters, thus often helping keep clean the water they connect to. They serve as buffers to catch and control what would otherwise be uncontrolled water and pollutants. Wetlands also play an essential role in the aquatic food chain (thus affecting fishery and water recreation), as well as serving as spaces for wildlife habitat, wildlife reproduction and nesting, and wildlife food.

The large areas of wetlands in the Easton Lake (shown in purple on Figure 7) serve as filters and traps that help keep at least some of the nutrient loading and sediment from entering Easton Lake. It is essential to preserve these wetlands for the health of Easton Lake.

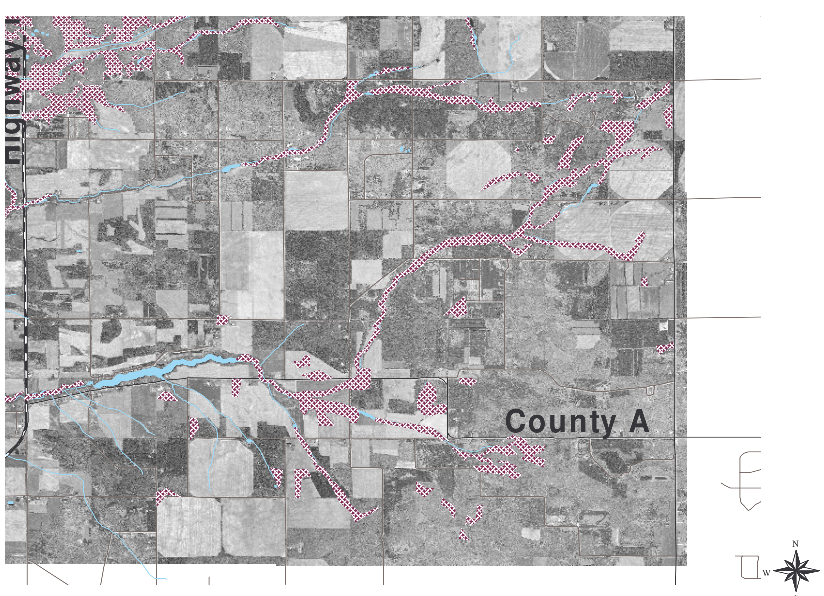


Figure 7: Close-up Map Showing Wetlands Upstream of Easton Lake

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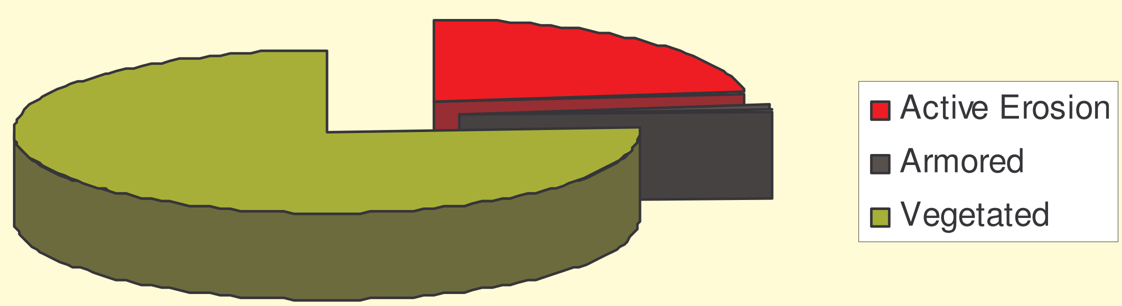
SHORELANDS

Easton Lake has a total shoreline of 2.11 miles (11,140.8 feet). Much of the lake shore is in residential use. Most of the areas near the shores are steeply sloped, except at the far northwest end, where the land is flatter. Several buildings along the shore are located very near the water line. Additionally, much of the shore has active erosion that is likely to be negatively impacting the water quality of the lake.

A shore survey was done on Easton Lake during the summer of 2004. At that time, native vegetation covered most of Easton Lake's shoreline. However, as the graph (Figure 8) shows, a significant amount of the shore revealed active erosion.

Figure 8: Easton Lake Shores



Easton Lake Shoreline Map

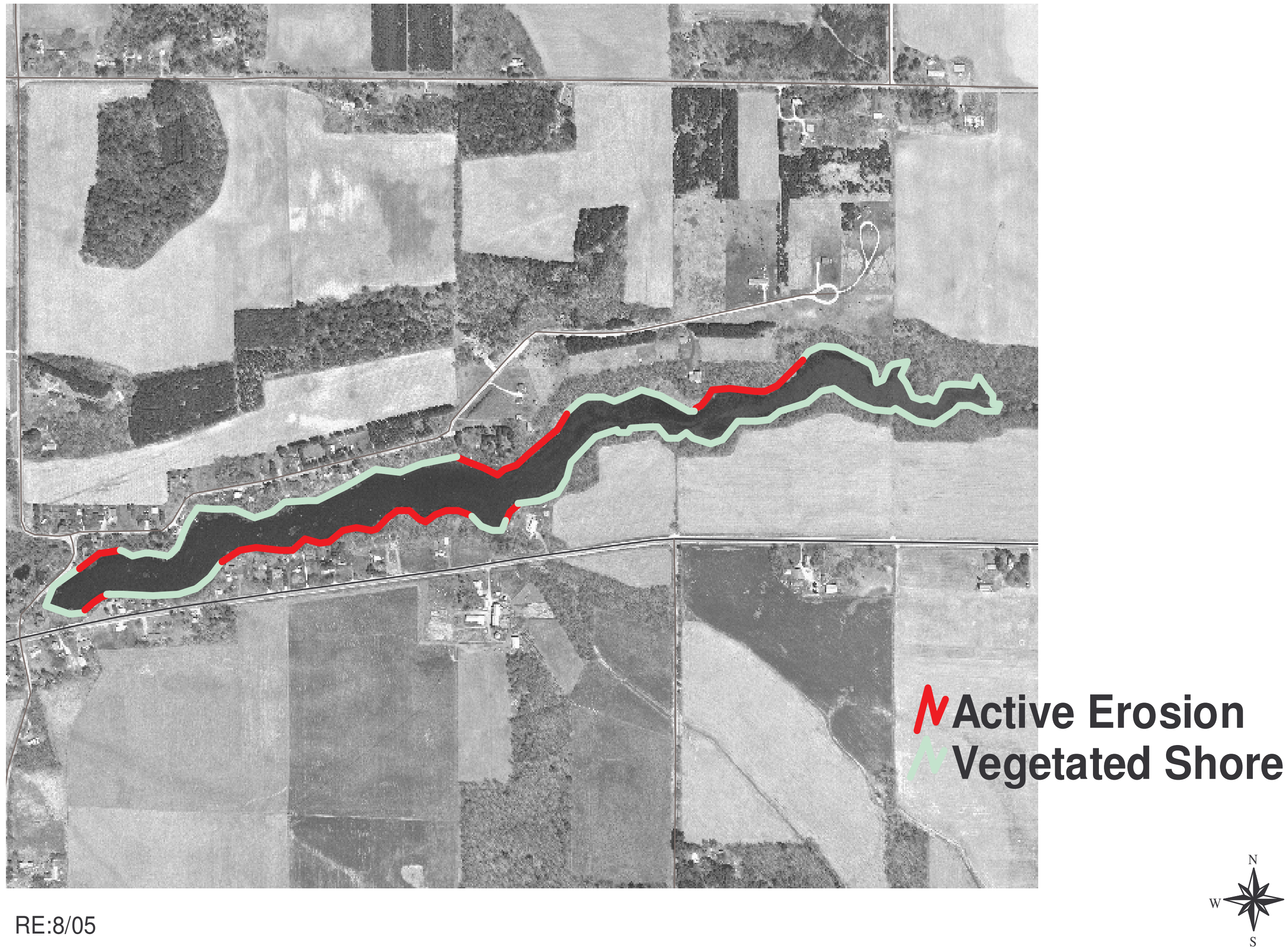


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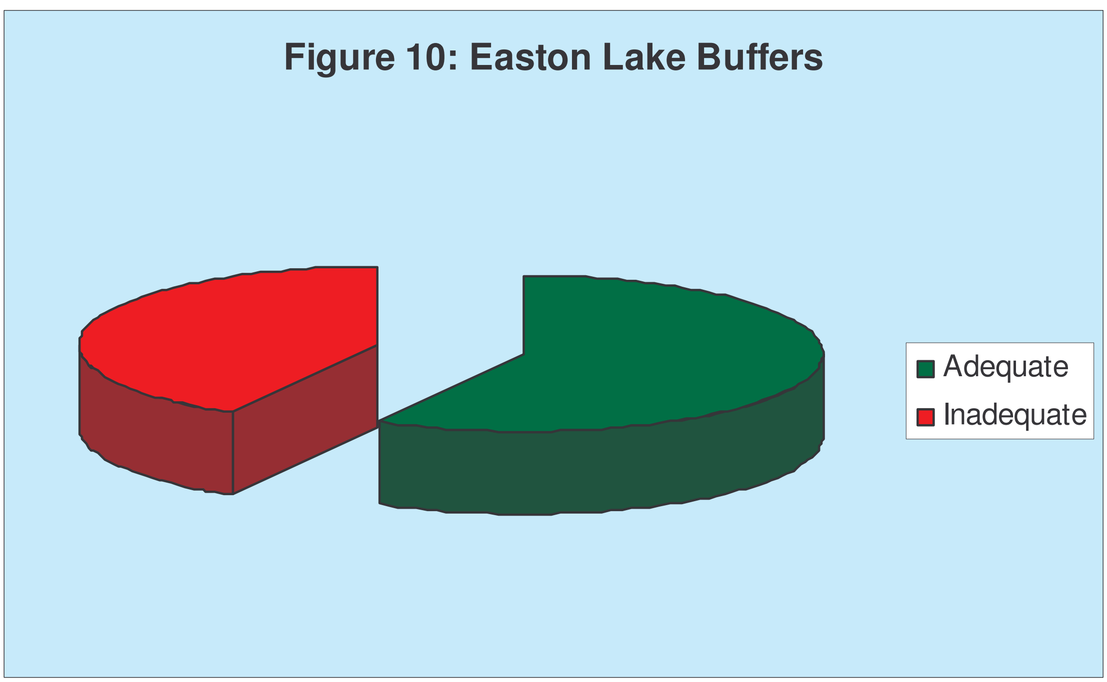
Figure 9: Shoreland Map of Easton Lake (2004)

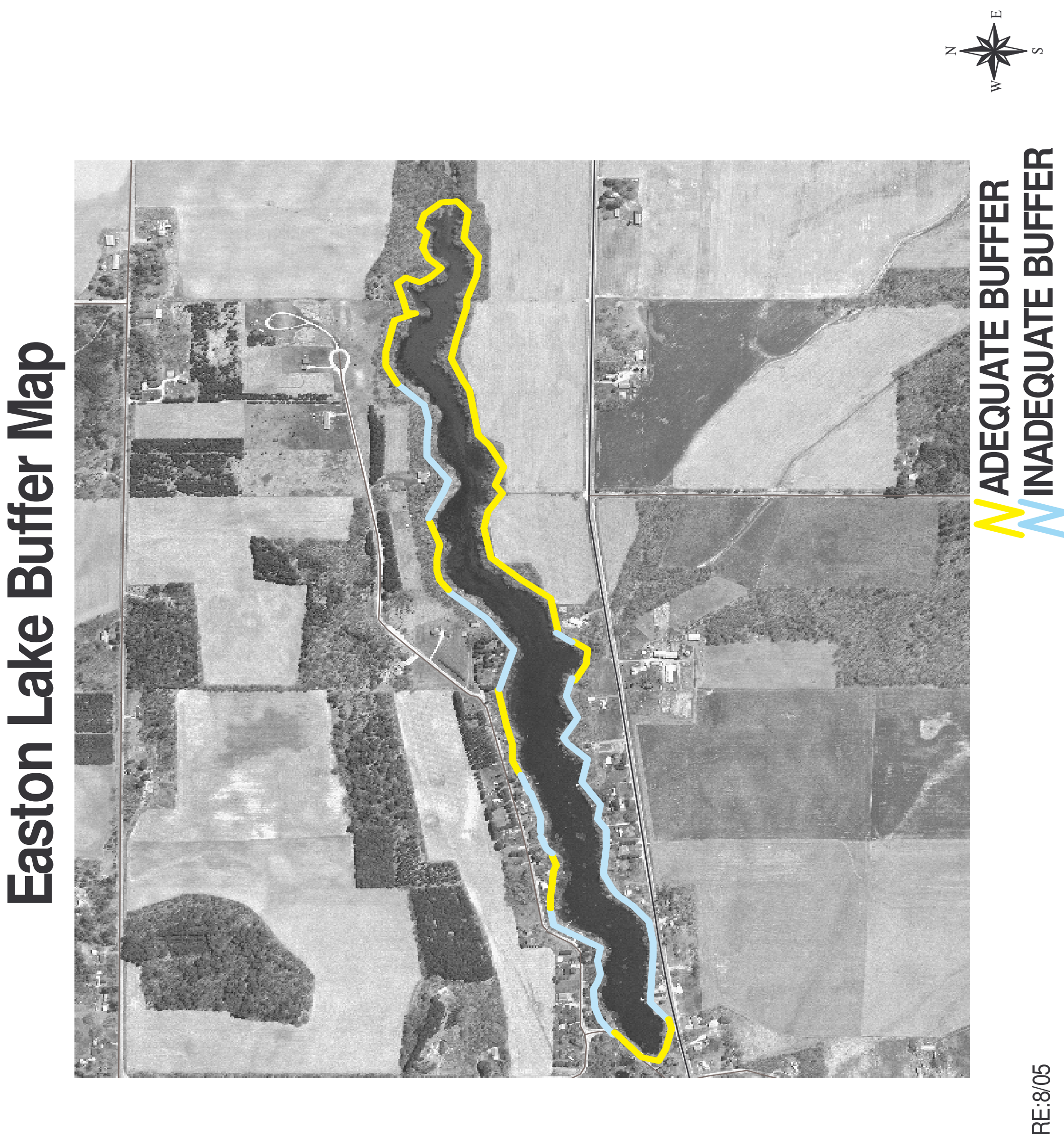
The Adams County Shoreline Ordinance defines 1000’ landward from the ordinary high water mark as “shoreland”. Under the ordinance, the first 35 feet landward from the water is a “buffer.” Shoreland buffers are an important part of lake protection and restoration. These buffers are simply a wide border of native plants, grasses, shrubs and trees that filter and trap soil & similar sediments, fertilizer, grass clippings, stormwater runoff and other potential pollutants, keeping them out of the lake. A 1990 study of Wisconsin shorelines revealed that a buffer of native vegetation traps 5 to 18 times more volume of potential pollutants than does a developed, traditional lawn or hard-armored shore.

The 2004 inventory included classifying areas of the Easton Lake shorelines as having “adequate” or “inadequate” buffers. An “adequate” buffer was defined as one having the first 35 feet landward covered by native vegetation. An “inadequate” buffer was anything that didn’t meet the definition of “adequate buffer”, including native vegetation strips less than 35 feet landward. Using these definitions, only 58.16% (6479.59 feet) of Easton Lake’s shoreline had an “adequate buffer” in 2004, leaving 41.84% (4661.31 feet) as “inadequate.” Most of the “inadequate” buffer areas were found with mowed lawns and/or insufficient native vegetation at the shoreline to cover 35 feet landward from the water line.



Vegetated shoreland buffers help stabilize shoreline banks, thus reducing bank erosion. The plant roots give structure to the bank and also increase water infiltration and decrease runoff. A vegetated shore is especially important when shores are steep and soft, as are several of Easton Lake shores, especially on the south side of the lake. Figure 11 maps the adequate and inadequate buffers on Easton Lake.

Figure 11: Easton Lake Buffer Map (2004)



Lakeside buffers also serve as important habitat. Lake edges usually contain aquatic and wetland plants, grading into drier groundcover, then shrubs and trees as one moves inland towards drier land. Buffers provide habitat for many species of water-dependent wildlife, including furbearers, reptiles, birds and insects. Many wildlife species, including birds, small mammals, fish & turtles breed, nest, forage and/or perch in shore buffer areas. Further, 80% of the endangered and threatened species listed spend part of their life in this near-lake buffer area. (Wagner et al, 2006)

When the natural shoreline is replaced by traditional mowed turf-grass lawns, rock, wooden walls or similar installments, bird and animal life, land-based insects, and aquatic insects that hatch or winter on natural shore are negatively impacted. For example, on many Adams County lakes, the non-native aquatic plant, Eurasian Watermilfoil has invaded. There is a weevil native to Wisconsin that weakens Eurasian Watermilfoil by burrowing into and developing within its stems, but that weevil depends on a native-plant shore to overwinter. If the shore is instead covered by rock, seawall or traditional lawn, these weevils will be unavailable for the lake to use as Eurasian Watermilfoil control.

The filtering process and bank stabilization that buffers provide help improve a lake's water quality, including water clarity. Studies in Minnesota, Maine and Michigan have shown that waterfront property value increases for every foot the water clarity of a lake increases. (Krysel et al, 2003).

Figure 12a: Example of Inadequate Vegetative Buffer

Figure 12b: Example of Adequate Buffer

Natural shoreland buffers serve important cultural functions. They enhance the lake's aesthetics. Studies have shown that aesthetics rank high as one of the reasons people visit or live on lakes. Shore buffers can provide visual & audio privacy screens for homeowners from other neighbors and/or lake users.

Adequate buffers on Easton Lake in some places could be easily installed on the inadequate areas by either letting the first 35 feet landward from the water just grow without mowing it, except for a path to the water, or by planting native seedlings sufficient to fill in the first 35 feet or using biologs to protect the shore that are vegetated. Where areas are deeply eroded and/or banks are high, shaping, revegetating and protecting the shores will be necessary to prevent further erosion.

WATER QUALITY

Between 2004 and 2006, Adams County Land & Water Conservation Department gathered water chemistry and other water quality information for Easton Lake. Part of the information was gained from periodic water sampling done by Adams County LWCD. Historic information about water testing on Easton Lake was also obtained from the testing done in relation to the two reports discussed earlier in this report.

Phosphorus

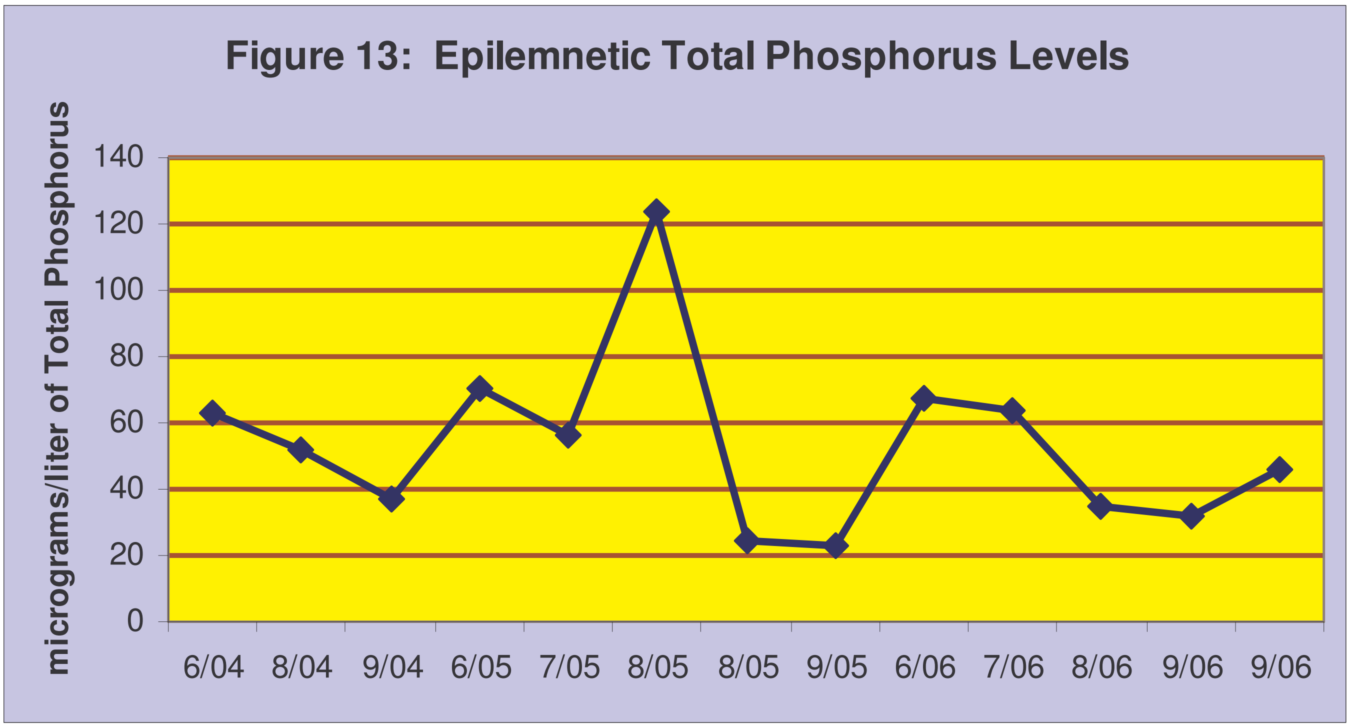
Most lakes in Wisconsin, including Easton Lake, are phosphorus-limited lakes: of the pollutants that end up in the lake, the one that most affects the overall quality of the lake water is phosphorus. The amount of phosphorus especially affects the frequency and density of aquatic vegetation and the frequency and density of various kinds of algae, as well as water clarity and other quality aspects. One pound of phosphorus can produce as much as 500 pounds of algae.

Phosphorus is not an element that occurs in high concentration naturally, so any lake that has significant phosphorus readings must have gotten that phosphorus from outside the lake or from internal loading. Some phosphorus is deposited onto the lake from atmospheric deposition, especially from soil or other particles in the air carrying phosphorus. A lake that includes a flooded wetland area may have a significant amount of phosphorus being released during the flushing of the wetland area. Phosphorus may accumulate in sediments from dying animals, dying aquatic plants and dying algae. If the bottom of the lake becomes anoxic (oxygen-depleted), chemical reactions may cause phosphorus to be released to the water column.

Although there are several forms of phosphorus in water, the total phosphorus (TP) concentration is considered a good indicator of a lake's nutrient status, since the TP concentration tends to be more stable than other types of phosphorus concentration. For an impoundment lake like Easton Lake, a total phosphorus concentration below 30 micrograms/liter tends to prevent nuisance algal blooms. Although the overall average for 2004-2006 for total phosphorus was 42.77 micrograms/liter, Easton Lake's growing season (June-September) surface average total phosphorus level of 53.3 micrograms/liter is considerably over the level at which nuisance algal blooms can be expected. Thus Easton Lake is likely to have nuisance phosphorus-related algal blooms.

Since phosphorus is usually the limited factor, measuring the phosphorus in a lake system thus provides an indication of the nutrient level in a lake. Increased phosphorus in a lake will feed algal blooms and also may cause excess plant growth.

The 2004-2006 summer average phosphorus concentration in Easton Lake places Easton Lake in the "fair" water quality section for impoundments, and at the "poor" level for phosphorus.



As Figure 13 indicates, the growing season total phosphorus levels have varied and usually registered above the level recommended to avoid nuisance algal blooms. Except for a spike in August 2005, the eplimnetic total phosphorus levels since June 2004 stayed below the state impoundment average of 65 micrograms/liter, but above the recommended level to avoid nuisance algal blooms. Especially due to the increasing epilimnetic total phosphorus levels, phosphorus should continue to be monitored and steps should be taken to reduce the phosphorus levels in the lake and greater watershed.

Groundwater testing of various wells around Easton Lake was done by Adams County LWCD and included a test one year for total phosphorus levels in the groundwater coming into the lake. The average TP level in the wells was 24.7 micrograms/liter, considerably lower than the lake surface water results. Even if some of this phosphorus from the other wells enters the lake from groundwater, it is unlikely to contribute significantly to the rising phosphorus levels.

Land use plays a major role in phosphorus loading. A key component of the computer models used is the phosphorus budget, that is, the estimated amount of phosphorus delivered to the lake from each land use type annually. The land uses that contribute the most phosphorus are non-irrigated agriculture and residences. Using the current land use data, as well as phosphorus readings from 2004 through 2006 water sampling, a phosphorus loading prediction model was run for Easton Lake. The current results are shown in Figure 14.

Figure 14: Current Phosphorus Loading by Land Use

MOST LIKELY PHOSPHORUS		
LOADING BY LAND USE	%	Current
Agriculture--Non Irrigated	28.8%	1058.2
Agriculture--Irrigated	38.0%	1394.8
Grassland/Pasture	0.2%	6.6
Residential	3.3%	118.8
Woodland	1.1%	39.6
Other Water	4.0%	149.6
Groundwatershed	24.0%	880
Septic	0.4%	14.52
Lake Surface	0.2%	6.6
Total in pounds/year	100.0%	3668.72

Currently, the most phosphorus loading is coming from agriculture in the surface, with a smaller portion coming from the ground watershed. Although phosphorus deposits such as that from flooded wetlands or from atmospheric deposition cannot be controlled by humans, phosphorus loads from human activities such as agriculture, residential development and septic systems can be partly controlled by changes in human land use patterns. Practices such as agricultural buffers, nutrient management, shoreland buffer restoration; infiltrating stormwater runoff from roof tops, driveways and other impervious surfaces; using no phosphorus lawn fertilizers; and reducing phosphorus input to and properly managing septic systems will minimize phosphorus inputs into the lake. Circumstances such as increased impervious surface, lawns mowed to water's edge, disturbance of shore areas, improperly-functioning septic systems and removal of native vegetation can greatly increase the volume and content of runoff—and thus increase the volume of phosphorus entering the lake. Many of these practices can also increase the concentration of phosphorus entering the lake, by runoff or other methods of entry.

The models were run using not only the current known phosphorus readings in the lake, but also representing decreases or increases of human-controlled phosphorus input by 10%, 25%, and 50%. Just a 10% reduction of the human-impacted phosphorus would reduce the overall load by 346.63 pounds/year. This figure may not seem like much--- until you calculate that one pound of phosphorus can result in up to 500 pounds of algae. A 10% reduction in these three areas could result in up to 173,315 pounds less of algae per year!

Figure 15: Table Showing Impacts of Reductions

Land Use		-10%	-25%	-50%
Agriculture--Non Irrigated	1058.2	952.38	793.65	529.10
Agriculture--Irrigated	1394.8	1255.32	1046.10	697.40
Grassland/Pasture	6.6	6.60	6.60	6.60
Residential	118.8	106.92	89.10	59.40
Woodland	39.6	39.60	39.60	39.60
Other Water	149.6	149.60	149.60	149.60
Groundwatershed	880	792.00	660.00	440.00
Septic	14.52	13.07	10.89	7.26
Lake Surface	6.6	6.60	6.60	6.60
Total in pounds/year	3668.72	3322.09	2802.14	1935.56

Reducing the amount of input from the surface and ground watersheds results in less nutrient loading into the lake itself. Under the modeling predictions, reducing phosphorus inputs from human-based activities even 10% could improve Easton Lake water quality by up to 12.4 micrograms. A 25% reduction could save up to 30.9 micrograms/liter. A 25% reduction could reduce the likelihood of nuisance algal blooms substantially. These predictions make it clear that reducing current phosphorus inputs to the lake are essential to improve, maintain and protect Easton Lake's health for future generations.

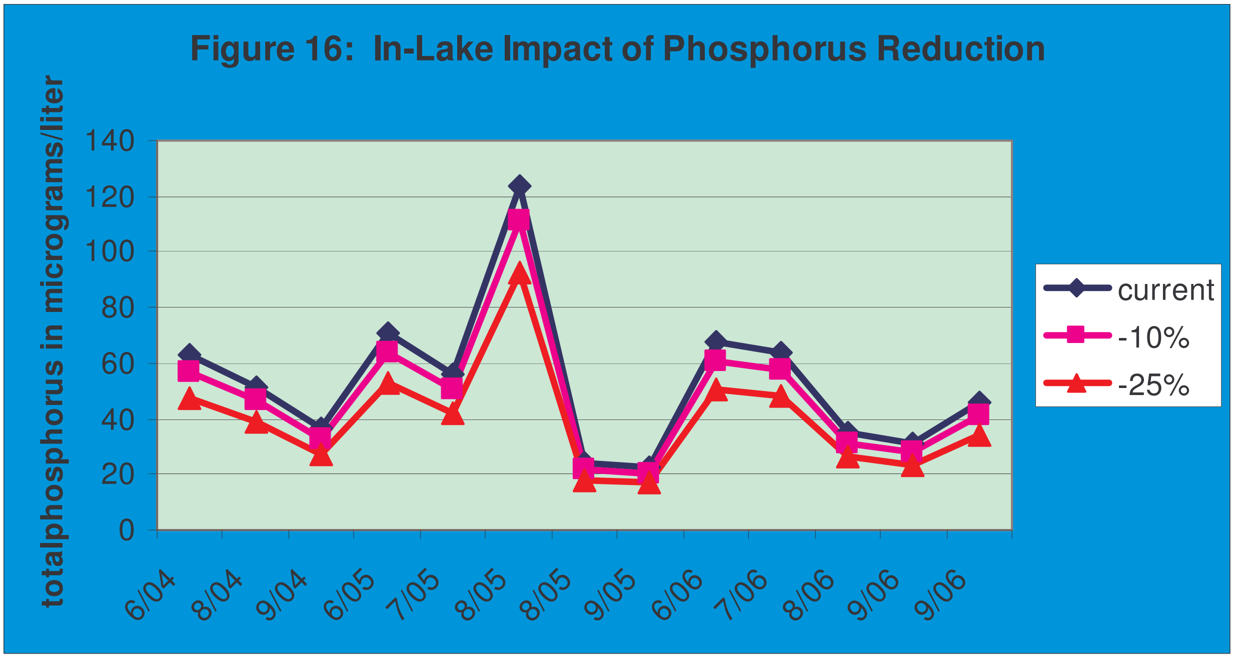
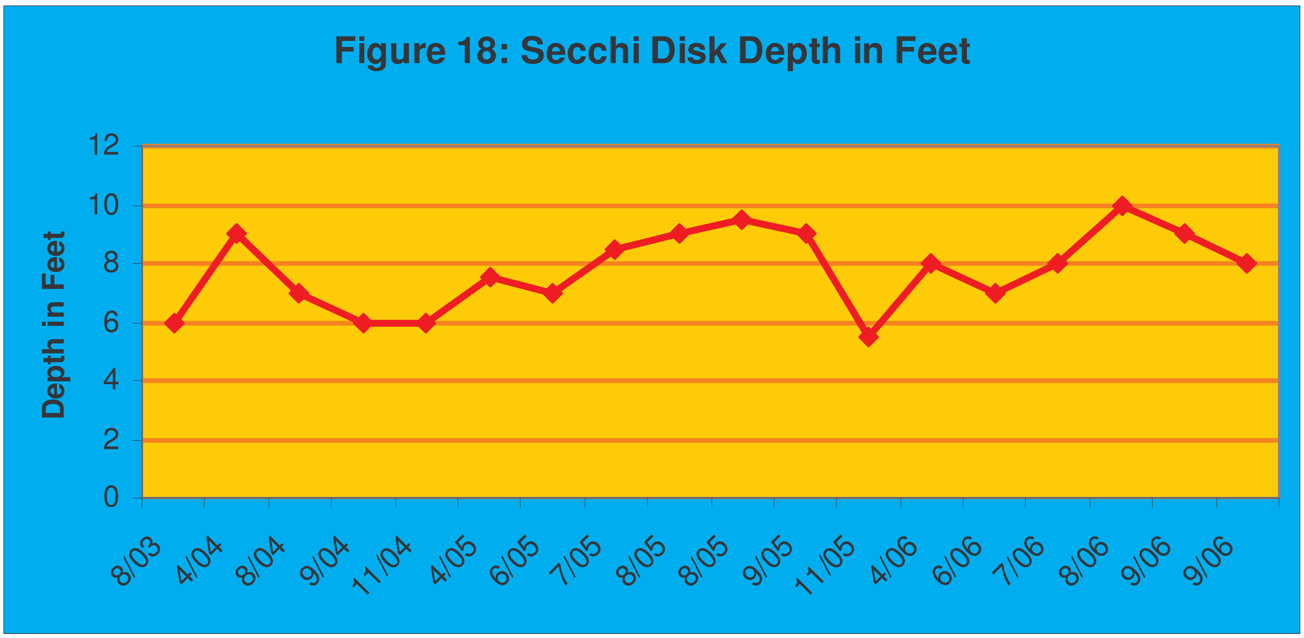


Figure 17: Photo of a Lake in Algal Bloom

Water Clarity

Water clarity is a critical factor for plants. If plants don't get more than 2% of the surface illumination, they won't survive. Water clarity can be reduced by turbidity (suspended materials such as algae and silt) and dissolved organic chemicals that color or cloud the water. Water clarity is measured with a Secchi disk. Average summer Secchi disk clarity in Easton in 2004-2006 was 7.8 feet. This is good water clarity, putting Easton Lake into the "mesotrophic" category for water clarity.



The study published in 2003 indicated that they encountered poor water clarity at times in the lake during their one year of study. However, it still averaged between 7 and 8 feet overall. This is consistent with the average growing season readings during the years that Adams County Land & Water was testing the water. However, there was generally good water clarity during the 2004-2006 testing, readings even above 8 feet several times. The difference might be accounted for because during the year that the earlier testing was done, the lake had forgone any treatment for aquatic plant and invasive plant management, so that the aquatic plant growth—which can often interfere with Secchi readings—was probably denser that it was in 2004-2006 after treatment had resumed. This may also account for the higher total phosphorus during the earlier study of an average of 71 micrograms/liter, with the highest reading taken in July, about the time when phosphorus levels would be elevated due to untreated curly-leaf pondweed dying off and adding phosphorus to the water column.

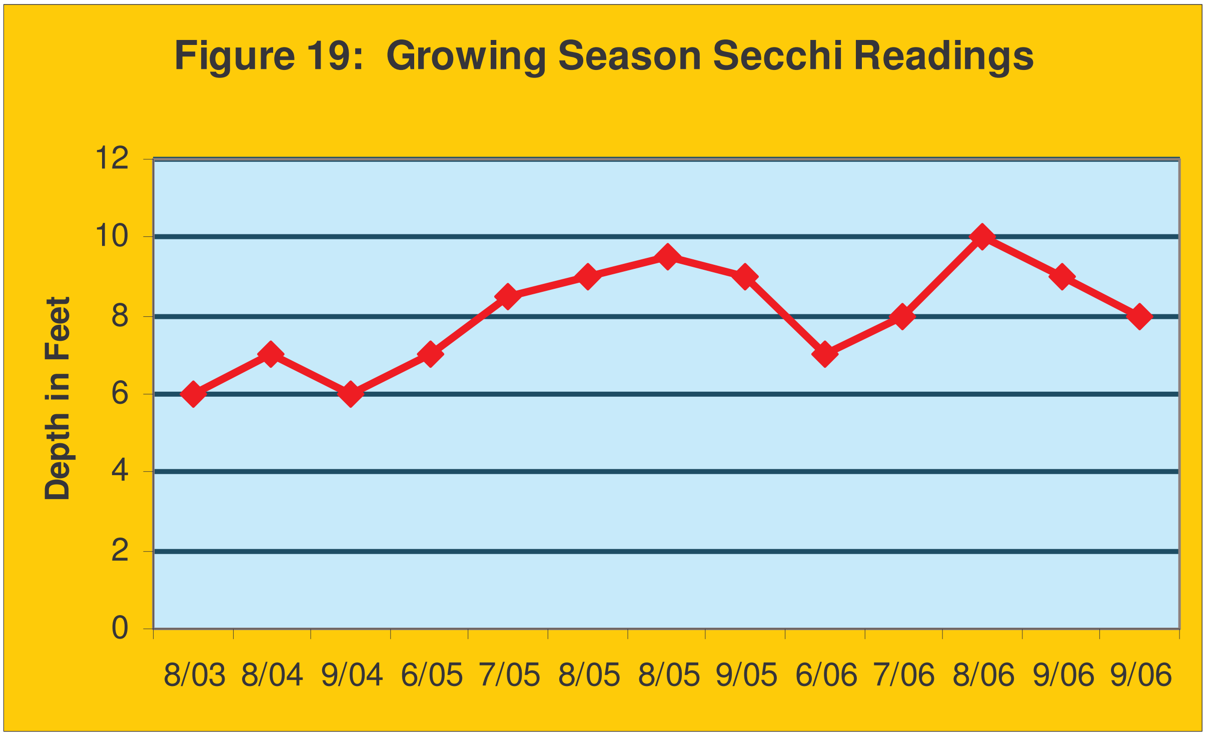
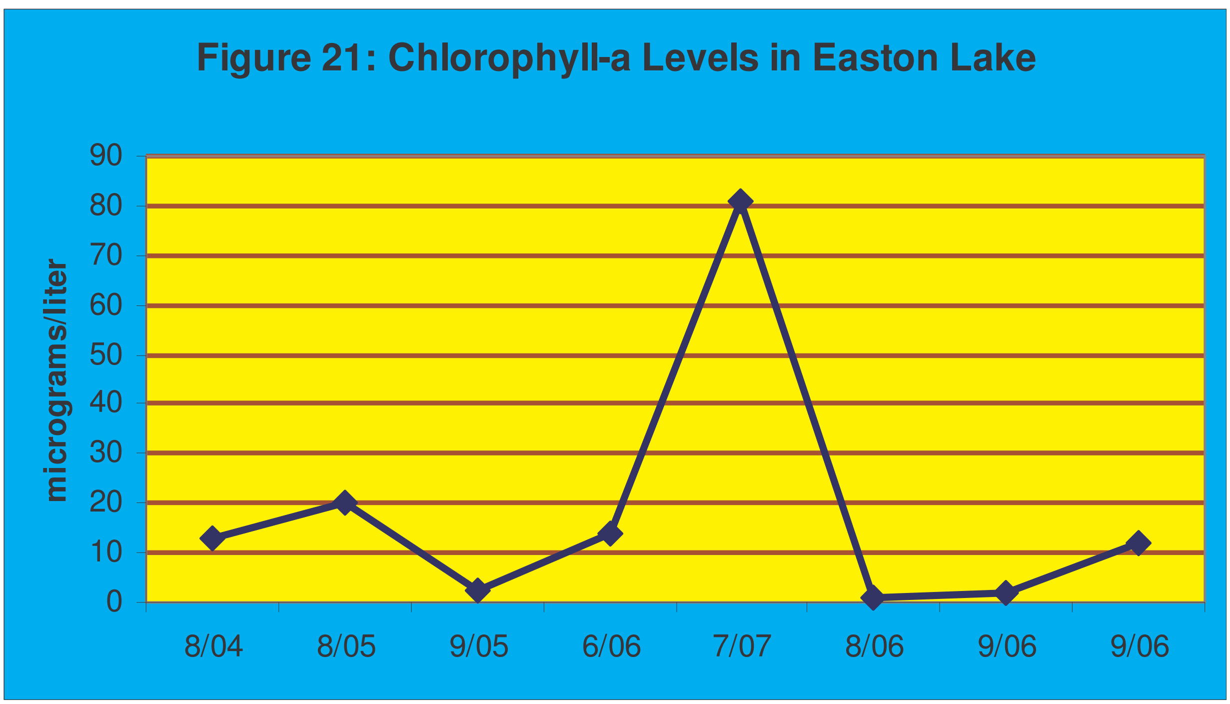


Figure 20: Photo of Testing Water Clarity with Secchi Disk

Chlorophyll a

Chlorophyll-a concentrations provide a measurement of the amount of algae in a lake's water. Algae are natural and essential in lakes, but high algal populations can increase water turbidity and reduce light available for plant growth, as well as result in unpleasing odor and appearance. Studies have shown that the amount of chlorophyll a in lake water depends greatly on the amount of algae present; therefore, chlorophyll-a levels are commonly used as a water quality indicator. The 2004-2006 growing season (June-September) average chlorophyll concentration in Easton Lake was 18.18 micrograms/liter. Such an algae concentration places Easton Lake at the "poor" level for chlorophyll-a results. The earlier study also took chlorophyll-a readings, reporting that the highest reading—of 18.7 micrograms/liter—was taken in July. Both studies had chlorophyll-a levels for the growing season falling in the "poor" category.



Dissolved Oxygen

Oxygen dissolved in the water is essential to all aerobic aquatic organisms. The oxygen in a lake comes from the atmosphere and from the process of photosynthesis. Aquatic plants and algae consume carbon dioxide and respirate oxygen back into the lake water. The distribution of oxygen within a lake is affected by many factors, including water circulation, water stratification, winds or storms, air temperature; water temperature, nutrient availability, and the density and location of algae and/or aquatic plants. During the summers of 2004 and 2006, dissolved oxygen levels went below levels 5 milligrams/liter appropriate level for good fish survival. Anoxia (no oxygen) occurred in August 2004, and hypoxia (low oxygen) occurred in June 2006 in the entire water column. The study published in 2003 noted similar periods of anoxia and hypoxia, including times when the entire water column was below 5 milligrams/liter, as it was in June 2006. The charts (Figures 22a, 22b, 22c, 22d) below show the annual (2002-2006) variations in dissolved oxygen levels in milligrams/liter, depth in feet and months of the years.

The development of hypoxia or anoxia can have negative effects. The first effect usually noticed by human is fish kills. Fish kills result when fish species that need cold oxygen-rich water to survive can't find it in the lake anymore or when some of their invertebrate food (such as mayfly nymphs) is gone due to low oxygen levels. Another noticeable effect can be an increase in the frequency and distribution of algal blooms. In some instances, anoxia can lead to blooms of toxic algae and the production of water-borne toxins that can harm humans and wildlife. Anoxia sometimes also leads to increased phosphorus cycling, undesirable water taste or odor levels, and interference with recreational uses such as swimming, boating and fishing.

As noted above, summer hypoxia or anoxia can result in phosphorus being released into the upper water column and being available for algal blooms and increased aquatic plant growth. This data shows that there is potential for phosphorus loading from the lower depths (hypolimnion) during the summer months in Easton Lake if the hypoxia/anoxia continues. Dissolved oxygen needs to be monitored during the late summer months in Easton Lake to determine whether hypoxia/anoxia is a frequently-occurring condition that may need to be addressed by management practices.

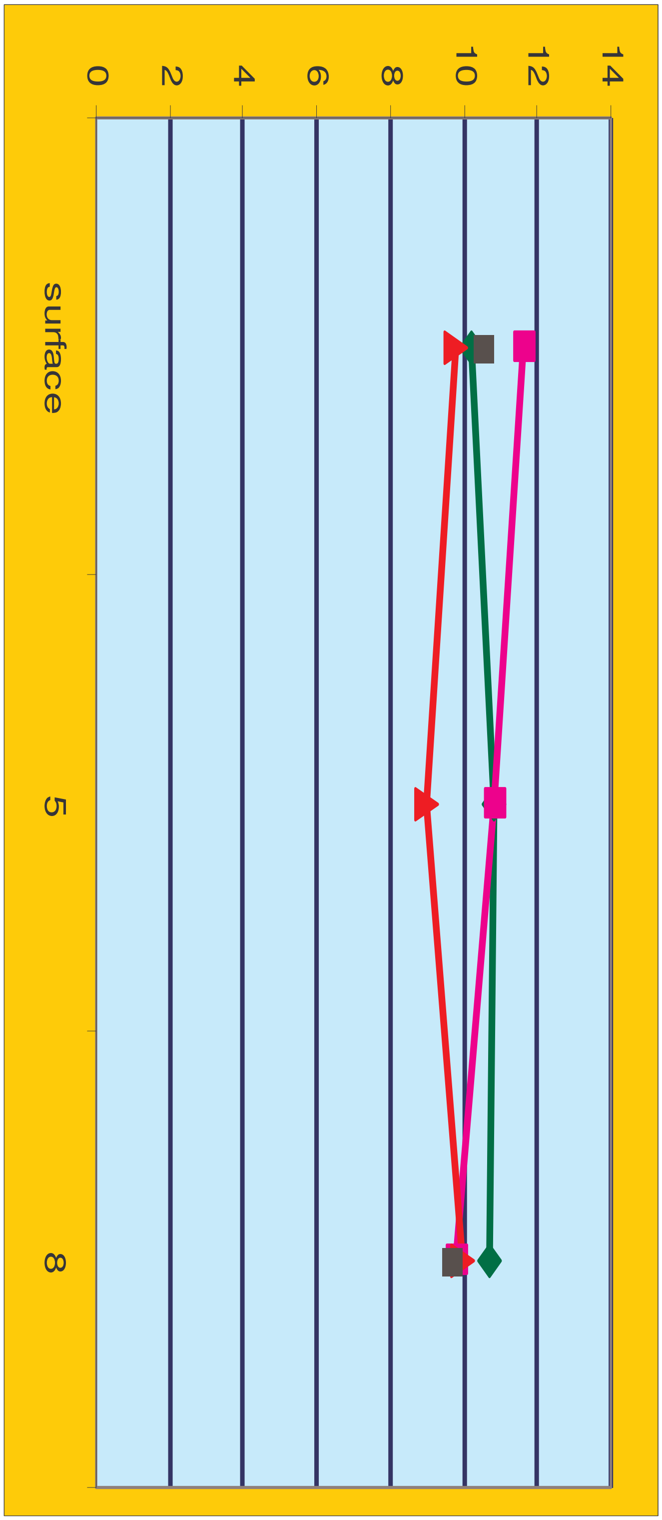
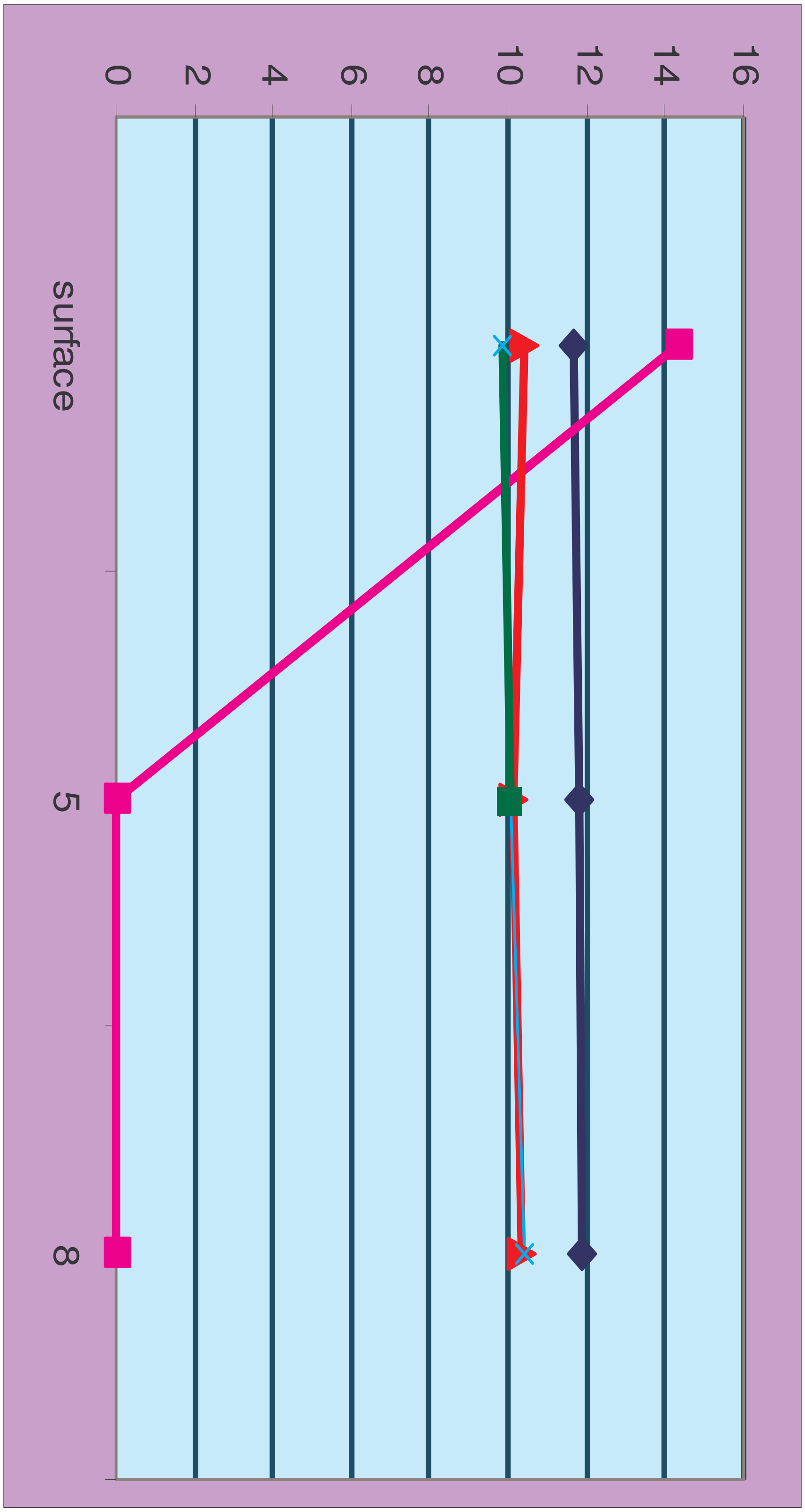


Figure 22a: DO v. Depth Readings in 2002 and 2003

Figure 22b: Dissolved Oxygen v. Depth in 2004 Testing in milligrams/liter



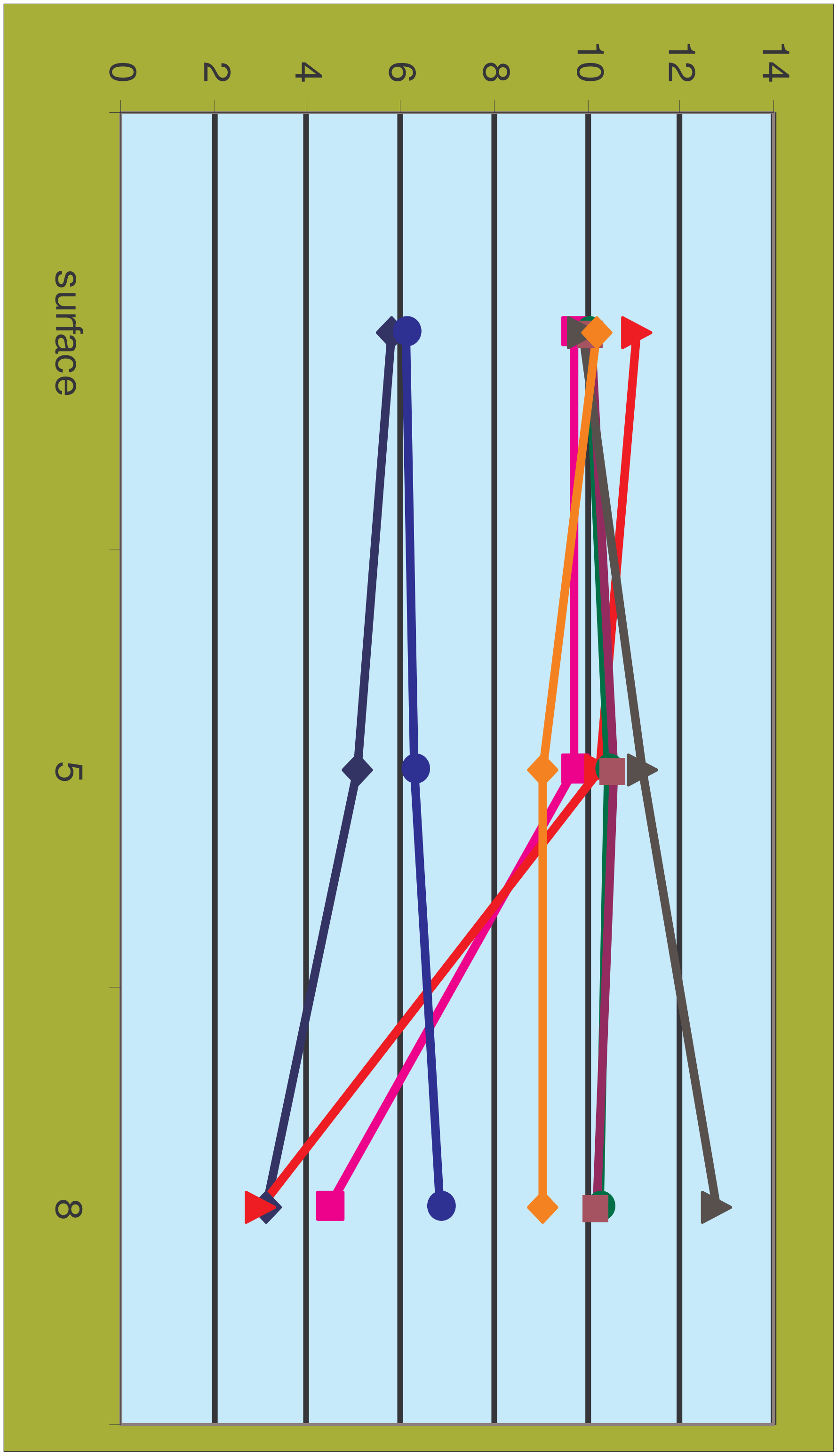


Figure 22c: Dissolved Oxygen Levels During 2005 Water Testing in milligrams/liter

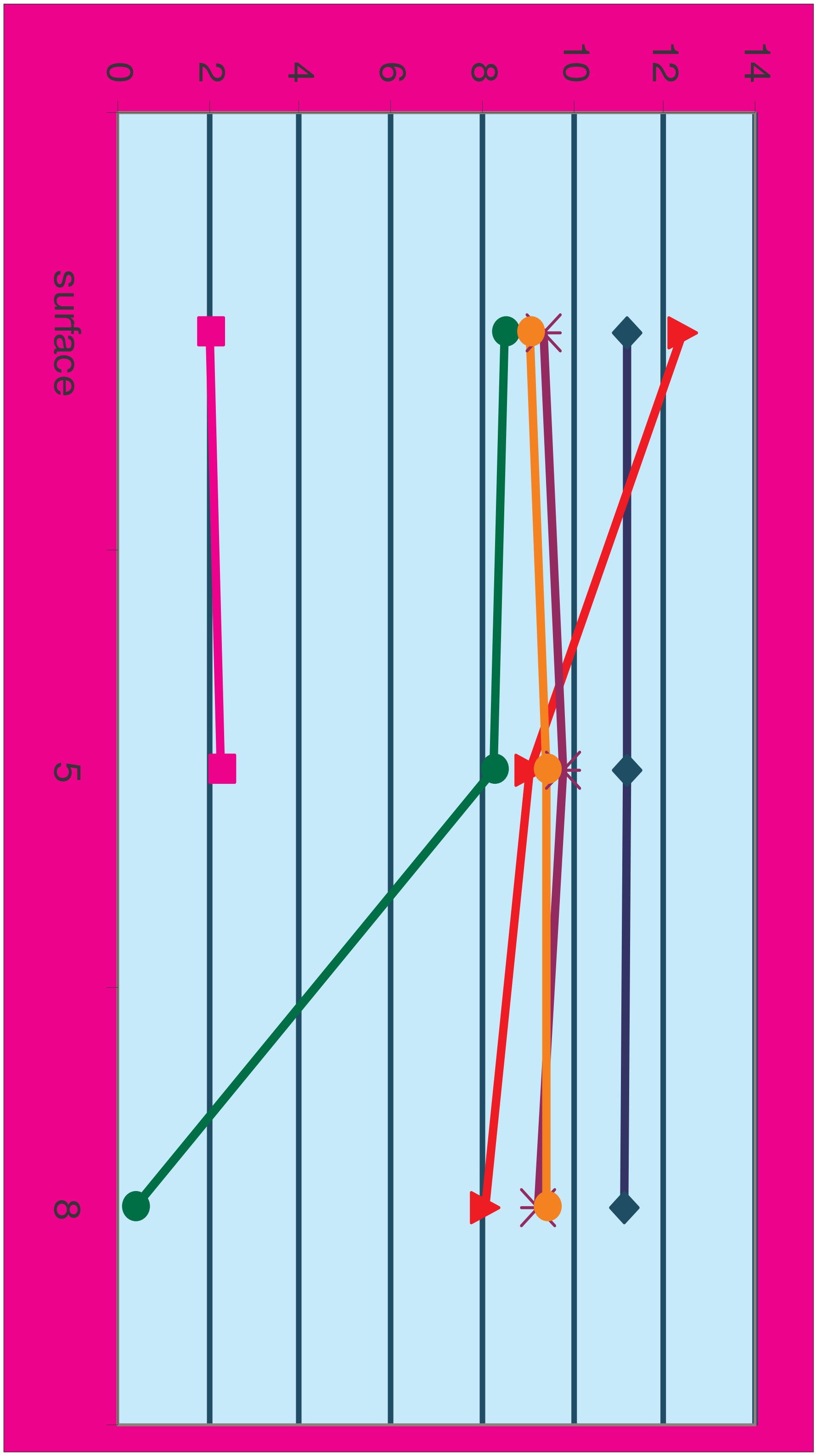


Figure 22d: Dissolved Oxygen v. Depth in 2006 Testing in milligrams/liter

4/06

6/06

7/06

8/06

9/06

9/06

Water Hardness, Alkalinity and pH

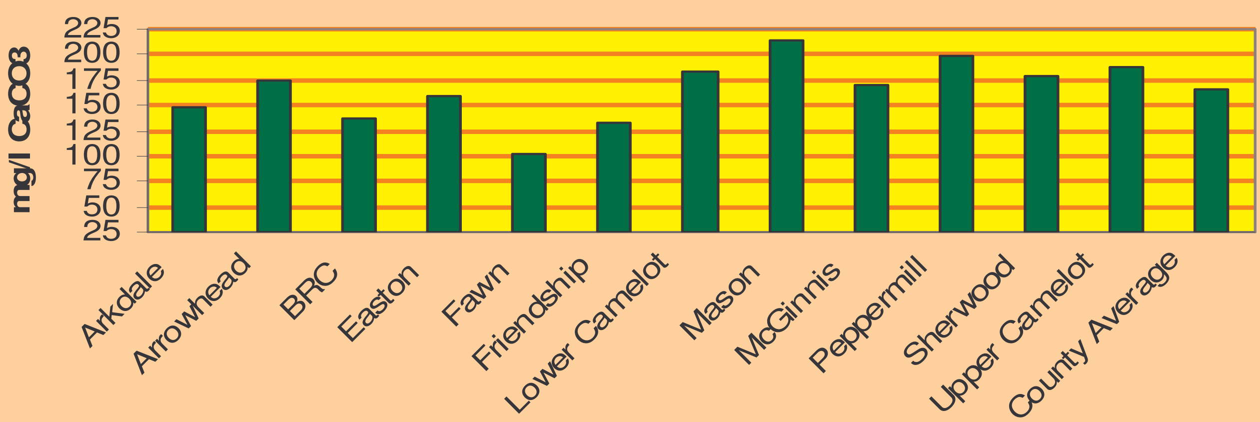
Testing done by Adams County LWCD on Easton Lake included annual testing for water alkalinity and water hardness. Hardness and alkalinity levels in a lake are affected by the soil minerals, bedrock type in the watershed, and frequency of contact between lake water & these materials.

Level of Hardness	Milligrams/liter $CaCO_3$
SOFT	0-60
MODERATELY HARD	61-120
HARD	121-180
VERY HARD	>180

Figure 23: Hardness Table

One method of evaluating hardness is to test the water for the amount of calcium carbonate ($CaCO_3$) it contains. The surface water of all of the public access lakes in Adams County have water that is moderately hard to very hard, whether they are impoundments (man-made lakes) or natural lakes. In 2005 and 2006, random samples were also taken of wells around Easton Lake to measure the hardness of the water coming into the lake through groundwater. Hardness in the groundwater ranged from 100 milligrams/liter (moderately hard) to 228 milligrams/liter (very hard), with an average of 145.4 milligrams/liter. Surface water hardness averaged 126 milligrams/liter, somewhat lower than the groundwater, but still hard. The hardness in both surface and groundwater is likely due to the underlying bedrock in Adams County, which is mostly sandstone with pockets of dolomite and shale.

Figure 24: Hardness in Adams County Impoundments



As the graph (Figure 24) shows, Easton Lake surface water testing results showed "hard" water (average 145.4 milligrams/liter CaCO3), less than the overall hardness average impoundments in Adams County of 166 milligrams/liter of Calcium Carbonate. Hard water lakes tend to produce more fish and aquatic plants than soft water lakes because they are often located in watersheds with soils that load phosphorus into the lake water.

Alkalinity is important in a lake to buffer the effects of acidification from the atmosphere. "Acid rain" has long been a problem with lakes that had low alkalinity level and high potential sources of acid deposition.

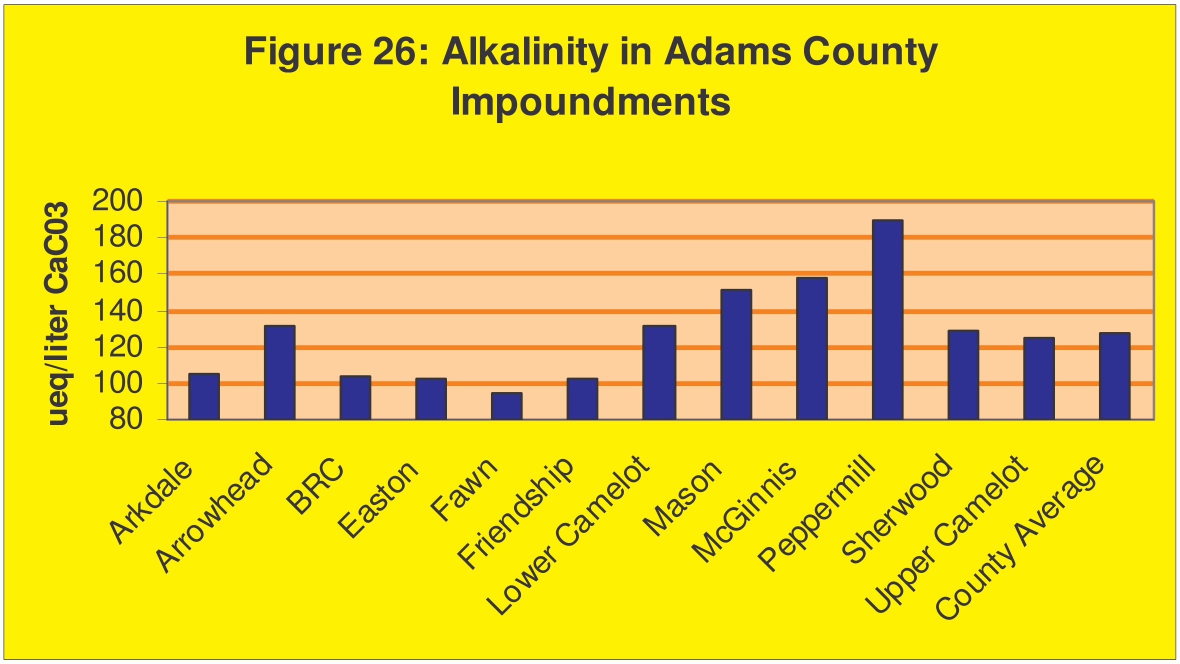
Acid Rain Sensitivity	ueq/l CaCO3
High	0-39
Moderate	49-199
Low	200-499
Not Sensitive	>500

Figure 25: Acid Rain Sensitivity

Well water testing results ranged from 92 milliequavalents/liter to 188 milliequivalents/liter in alkalinity, with an average of 123.6 milliequivalents/liter. This is higher than the surface water average of 102.4 milliequivalents/liter. Easton Lake's potential sensitivity to acid rain is moderate, but luckily for Adams County, the acid deposition rate is very low, probably due to the little industrialization in the county.

Alkalinity also affects the pH level of lake water. The acidity level of a lake's water regulates the solubility of many minerals. A pH level of 7 is neutral. The pH level in Wisconsin lakes ranges from 4.5 in acid bog lakes to 8.4 in hard water, marl lakes.

Some of the minerals that become available under low pH, especially the metals aluminum, zinc and mercury, can inhibit fish reproduction and/or survival. Even what seems like a small variance in pH can have large effects because the pH scale is set up so that every 1.0 unit change increases acidity tenfold, i.e., water with a pH of 7 is 10 times more acid than water with pH of 8. Mercury and aluminum are not only toxic to many kinds of wildlife; they can also be toxic to humans, especially those that eat tainted fish.



The testing occurring from 2004-2006 also included regular monitoring of the pH at several depths in Easton Lake. As is common in the lakes in Adams County, Easton Lake has pH levels starting at just over neutral (7.31) at 20 feet depth and increasing in alkalinity as the depth gets less, until the surface water pH averages 7.75. A lake's pH level is important for the release of potentially harmful substances and also affects plant growth, fish reproduction and survival. Most plants grow best at pH levels between 5.5 and 8.

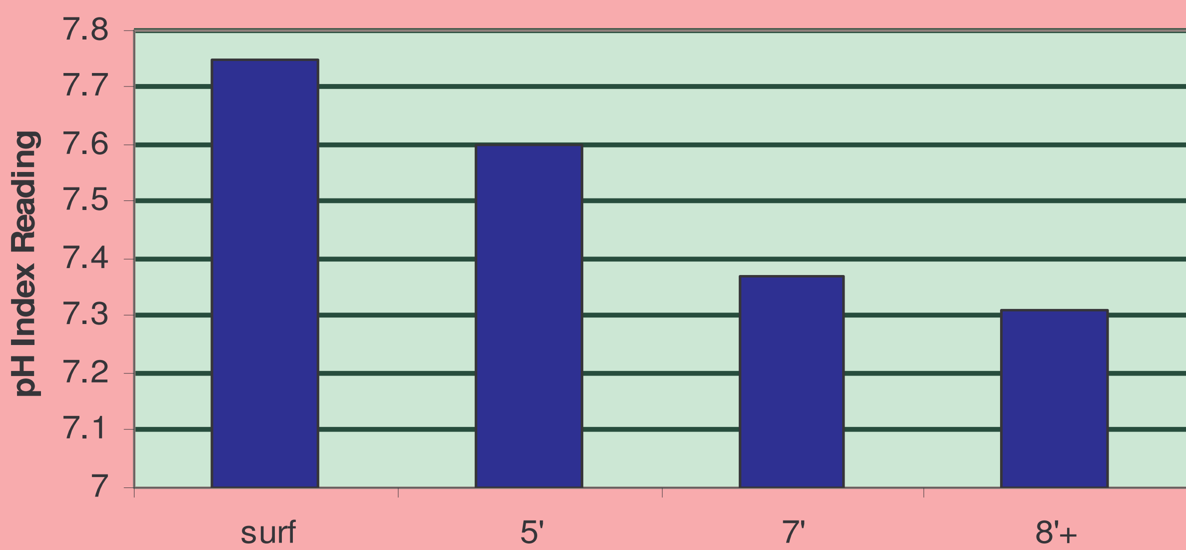
More importantly for many lakes, fish reproduction and survival are very sensitive to pH levels. The chart below indicates the effect of pH levels under 6.5 on fish (Figure 27):

Figure 27: Effects of pH Levels on Fish

Water pH	Effects
6.5	walleye spawning inhibited
5.8	lake trout spawning inhibited
5.5	smallmouth bass disappear
5.2	walleye & lake trout disappear
5	spawning inhibited in most fish
4.7	Northern pike, sucker, bullhead, pumpkinseed, sunfish & rock bass disappear
4.5	perch spawning inhibited
3.5	perch disappear
3	toxic to all fish

No pH levels taken in Easton Lake between 2004-2006 fell below the pH level that inhibits walleye reproduction. A lake with a neutral or slightly alkaline pH like Easton Lake is a good lake for fish and plant survival. Natural rainfall in Wisconsin averages a pH of 5.6. This means that if the rain falls on a lake without sufficient alkalinity to buffer that acid water coming in by rainfall, the lake's fish cannot reproduce. That is not a problem at Easton Lake. Easton Lake has a good pH level for fish reproduction and survival.

Figure 28: pH v. Depth in Easton Lake



Other Water Quality Testing Results

CHLORIDE: Chloride does not affect plant and algae growth and is not known to be harmful to humans. It isn't common in most Wisconsin soils and rocks, so is usually found only in very low levels in Wisconsin lakes. However, the presence of a significant amount of chloride over a period of time indicates there may be negative human impacts on the water quality present from septic system failure, the presence of fertilizer and/or waste, deposition of road-salt, and other nutrients. An increased chloride level is thus an indication that too many nutrients are entering the lake, although the level has to be evaluated compared to the natural background data for chloride. The average chloride level found in Easton Lake during the testing period was 4.2 milligrams/liter, elevated substantially above the natural level of 3 milligrams/liter for chloride in this area of Wisconsin. The same elevated level was noted in the study published in 2003 as well. Further investigation as to the cause of such elevations needs to be performed.

NITROGEN: Nitrogen is necessary for plant and algae growth. A lake receives nitrogen in various forms, including nitrate, nitrite, organic, and ammonium. In Wisconsin, the amount of nitrogen in a lake's water often corresponds to the local land use. Although some nitrogen will enter a lake through rainfall from the atmosphere, that coming from land use tends to be in higher concentrations in larger amounts, coming from fertilizers, animal and human wastes, decomposing organic matter, and surface runoff. For example, the growth level of the exotic aquatic plant, Eurasian Watermilfoil (*Myriophyllum spicatum*) has been correlated with fertilization of lake sediment by nitrogen-rich spring runoff.

Nitrogen levels can affect other aspects of water quality. The sum of water testing results for nitrate, nitrite and ammonium levels of over .3 milligrams/liter in the spring can be used to project the likelihood of an algal bloom in the summer (assuming sufficient phosphorus is also present). Easton Lake combination spring levels from 2004 to 2006 averaged 2.84 milligrams/liter, far above the .3 milligrams/liter predictive level for nitrogen-related algal blooms. Similar elevations were noted in the 2003 report. These elevations suggest that some of the algal blooms on Easton Lake may be at least partly nitrogen-related. Easton Lake has had an ongoing problem with fairly large and frequent algal blooms during the growing season which may be both high phosphorus and high nitrogen-related.

With elevations of both chloride and nitrogen noted for the past several years, Easton Lake District needs to investigate what human influences are responsible for these elevations and how the levels might be reduced.

CALCIUM and MAGNESIUM: Calcium is required by all higher plants and some microscopic lifeforms. Magnesium is needed by chlorophyllic plants and by algae, fungi and bacteria. Both calcium and magnesium are important contributors to the hardness of a lake's waters. Magnesium elevated about 125 milligrams/liter may have a laxative effect on some humans. Otherwise, no health hazards to humans and wildlife are known from calcium and magnesium. The average Calcium level in Easton Lake's water during the testing period was 28.23 milligrams/liter. The average Magnesium level was 13.84 milligrams/liter. Both of these are low-level readings.

SODIUM AND POTASSIUM: These elements occur naturally only in low levels in Wisconsin waters and soils. Their presence may indicate human-caused pollution.

Sodium is found with chloride in many road salts and fertilizers and is also found in human and animal waste. Potassium is found in many fertilizers and also found in animal waste. The level of these two is generally not useful as a specific pollution indicator, but increasing levels or one or both of these elements can indicate possible contamination from damaging pollutants. High levels of sodium have also been found to influence the development of a large population of cyanobacteria, some of which can be toxic to animals and humans. Some health professionals have suggested that sodium levels over 20 milligrams/liter may be harmful to heart and kidney patients if ingested. Both the potassium level of 0.74 is very low, and the average sodium level in of 2.05 milligrams/liter was also low. The earlier report indicated potassium level of 0.7 milligrams/liter and sodium level of 2.1 milligrams/liter. These two elements have remained stable.

SULFATE: In low-oxygen waters (hypoxic), sulfate can combine with hydrogen and becomes the gas hydrogen sulfate, which smells like rotten eggs and is toxic to most aquatic organisms. Sulfate levels can also affect the metal ions in the lake, especially iron and mercury, by binding them up, thus removing them from the water column. To prevent the formation of hydrogen sulfate, levels of 10 milligrams/liter are best. A health advisory kicks in at 30 milligrams/liter. Easton Lake sulfate levels averaged 12.13 milligrams/liter during the testing period, above the level for hydrogen sulfate formation, but below the health advisory level. However, this is slightly higher than the 10.4 milligrams/liter noted in the 2003 report.

TURBIDITY: Turbidity reflects water clarity. The term refers to suspended solids in the water column—solids that may include clay, silt, sand, plankton, waste, sewage and other pollutants. Turbid water may mask the presence of bacteria or other pollutants because the water looks murky or muddy. In general, turbidity readings of less than 5 NTU are best. Very turbid waters may not only smell, but also tend to be aesthetically displeasing, thus curtailing recreational uses of the water. Turbidity levels for Easton Lake's waters were 1.8 NTU in 2004, 1.89 NTU in 2005 and 2.28 NTU in 2006—all below the level of concern.

Figure 29: Examples of Very Turbid Water

HYDROLOGIC BUDGET

According to date in a 1969 WDNR bathymetric (depth) map, Easton Lake had 24.1 surface acres, with a maximum depth of 11 feet. At that time, 27% of the lake was less than 3 feet deep. Mean depth was 5 feet deep. Lake volume was 129 acre-feet.

A "hydrologic budget" is an accounting of the inflow to, outflow from and storage in a hydrological unit (such as a lake). "Residence time" is the average length of time particular water stays within a lake before leaving it. This can range from several days to years, depending on the type of lake, amount of rainfall, and other factors. "Flushing rate" is the time it takes a lake's volume to be replaced. "Annual runoff volume", as used in WiLMS, is the total water yield from the drainage area reaching the lake. The "drainage area" is the amount of area (in acres) contributing surface water runoff and nutrients to the lake. The "areal water load" is the total annual flow volume reaching the lake divided by the surface area of the lake. "Hydraulic loading" is the total annual volume of all water sources (including precipitation, non-point sources & point sources) loading into the lake.

Using the data gathered from historical testing and that done by the Adams County LWCD from 2004-2006, the WiLMS model calculated the tributary drainage area for Easton Lake as 13431.1 acres. The average unit runoff for Adams County in the Easton Lake area is 9.4 inches. WiLMS determined the expected annual runoff volume as 10521 acre-feet/year. Anticipated annual hydraulic loading is 10526.3 acre-feet/year. Areal water load is 436.8 feet/year. In an impoundment lake like Easton Lake, a significant portion of the water and its nutrient load running through it from the impounded creek tend to flush through the lake and continue downstream—in Easton Lake's case, modeling estimates a water residence of 0.01 year (less than 4 days). The calculated lake flushing rate is 81.6 1/year. Water and its load flow through Easton Lake fairly quickly.

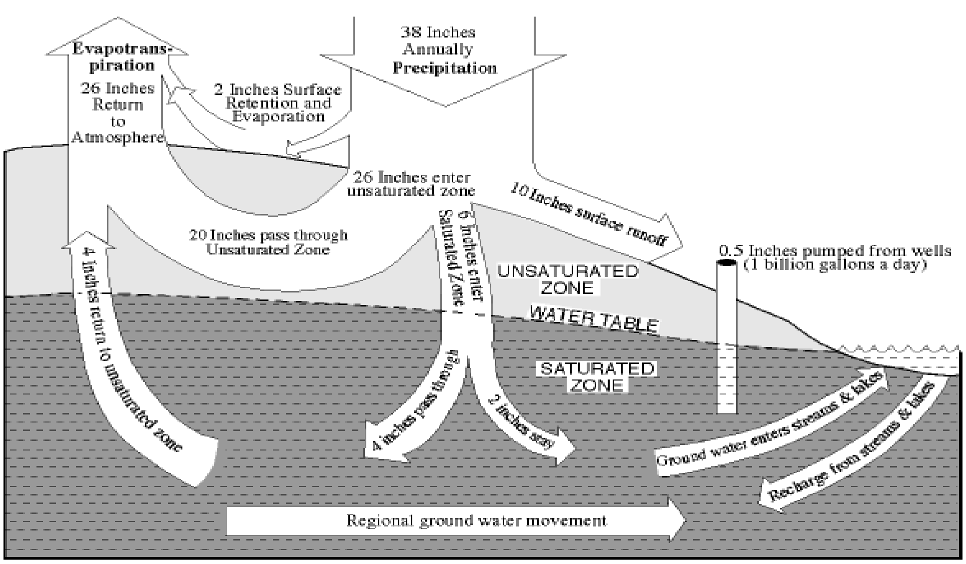
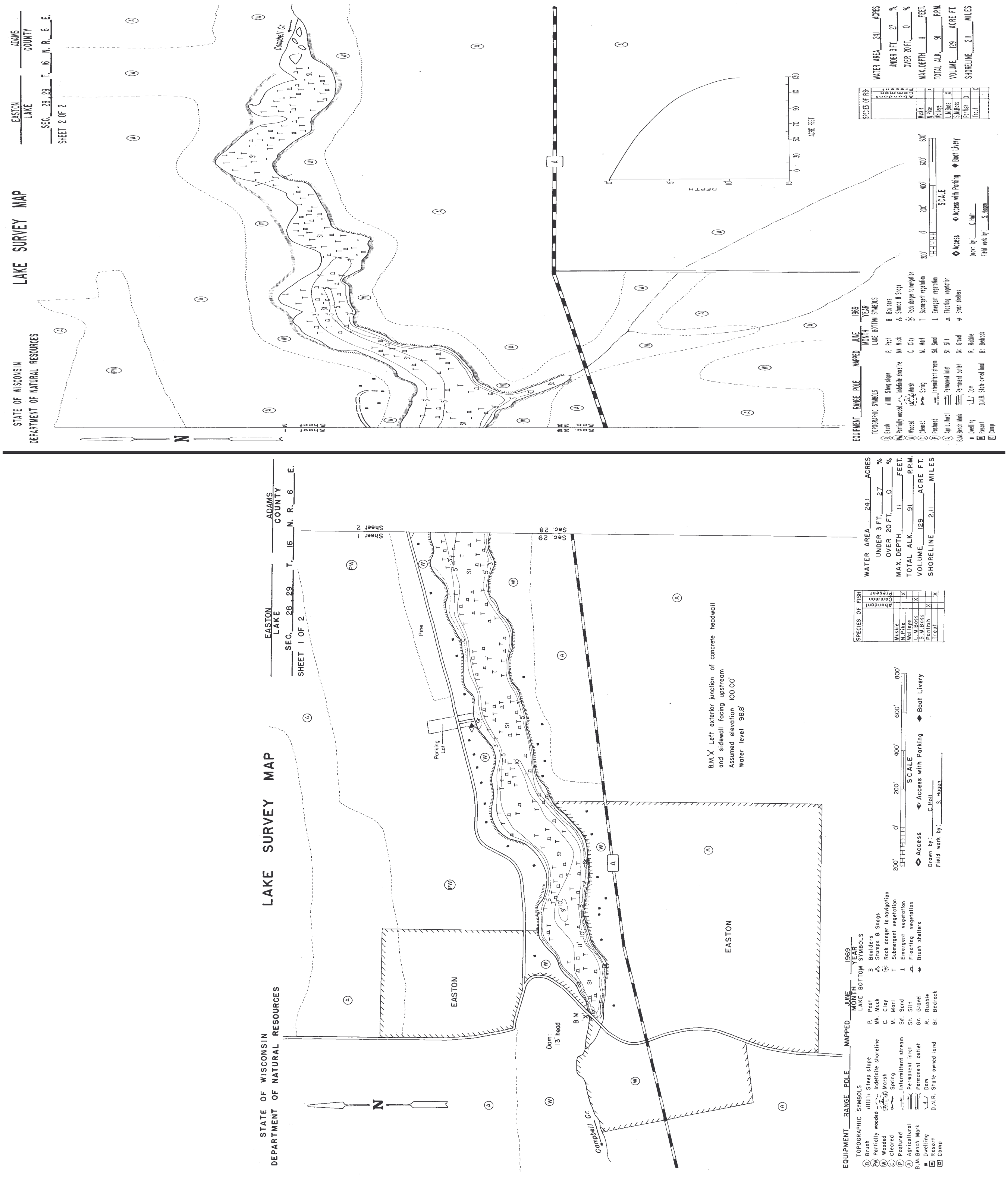


Figure 30: Example of Hydrologic Budget

Figure 31: Bathymetric Map of Easton Lake (1969)



TROPHIC STATE

The trophic state of a lake is one measure of water quality, basically defining the lake's biological production status (see Figure 32). **Eutrophic lakes** are very productive, with high nutrient levels, frequent algal blooms and/or abundant aquatic plant growth. **Oligotrophic lakes** are those low in nutrients with limited plant growth and small populations of fish. **Mesotrophic lakes** are those in between, i.e., those which have increased production over oligotrophic lakes, but less than eutrophic lakes; those with more biomass than oligotrophic lakes, but less than eutrophic lakes; often with a more varied fishery than either the eutrophic or oligotrophic lakes. In comparing water quality testing results with the prediction from the computer modeling of this modeling with the actual figures outlined above, the actual Trophic State of Easton Lake is what was predicted from the modeling. Modeling results predicted that the overall TSI for Easton Lake would be **54**. This score places Easton Lake's overall TSI at over the average for impoundment lakes in Adams County (52.83). Easton Lake is above the county impoundments average for overall TSI levels—which is negative, since with TSI levels, the lower the better.

Figure 32: Trophic Status Table

Score	TSI Level Description
30-40	**Oligotrophic:** clear, deep water; possible oxygen depletion in lower depths; few aquatic plants or algal blooms; low in nutrients; large game fish usual fishery
40-50	**Mesotrophic:** moderately clear water; mixed fishery, esp. panfish; moderate aquatic plant growth and occasional algal blooms; may have low oxygen levels near bottom in summer
50-60	**Mildly Eutrophic:** decreased water clarity; anoxic near bottom; may have heavy algal bloom and plant growth; high in nutrients; shallow eutrophic lakes may have winterkill of fish; rough fish common
60-70	**Eutrophic:** dominated by blue-green algae; algae scums common; prolific aquatic plant growth; high nutrient levels; rough fish common; susceptible to oxygen depletion and winter fishkill
70-80	**Hypereutrophic:** heavy algal blooms through most of summer; dense aquatic plant growth; poor water clarity; high nutrient levels

Easton Lake = 54

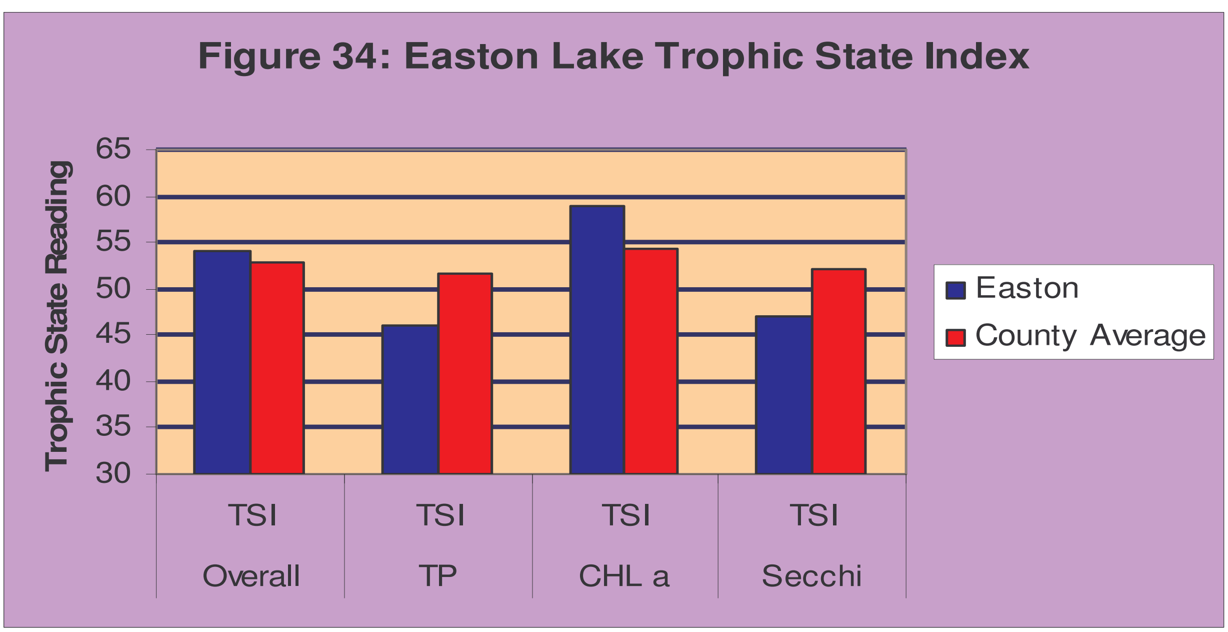
Phosphorus concentration, chlorophyll-a concentration and water clarity data are collected and combined to determine a trophic state. As discussed earlier, the average growing season epilimnetic total phosphorus for Easton Lake was 53.3 micrograms/liter. The average growing season chlorophyll-a concentration was 17.2

micrograms/liter. Growing season water clarity averaged a depth of 7.8 feet. Figure 33 shows where each of these measurements from Easton Lake fall in trophic level.

Figure 33: Easton Lake Trophic Status Overview

Trophic State	Quality Index	Phosphorus	Chlorophyll a	Sechhi Disk
		(ug/l)	(ug/l)	(ft)
Oligotrophic	Excellent	<1	<1	>19
	Very Good	1 to 10	1 to 5	8 to 19
Mesotrophic	Good	10 to 30	5 to 10	**6 to 8**
	Fair	30 to 50	10 to 15	5 to 6
Eutrophic	Poor	**50 to 150**	**15 to 30**	3 to 4
Easton Lake		**53.3**	**17.2**	**7.8**

These figures show that Easton Lake has poor to good levels overall for the three parameters often used to described water quality: Secchi disk depths; average TP for the growing season; and chlorophyll a levels. It is normal for all of these values to fluctuate during a growing season. However, they can be affected by human use of the lake, by summer temperature variations, by algae growth & turbidity, and by rain or wind events



IN-LAKE HABITAT

Aquatic Plants

A healthy aquatic plant community plays a vital role within the lake community. This is due to the role plants play in improving water quality, providing valuable habitat resources for fish and wildlife, resisting invasions of non-native species and checking excessive growth of the most tolerant species.

In 2005, a qualitative aquatic plant survey was done on Easton Lake by staff from Adams County Land & Water Conservation Department and a member of the Easton Lake District. Information about prior aquatic plant surveys is sketchy. The 1981 study outlined plants by scientific names and categories of "abundant", "common" or "scarce", without providing more specific information as to relative frequency, density or dominance or transferring the information to use established calculations for various aquatic plant indices. Similarly, the 2003 report defined the plant community as beow average and tolerant of poor water clarity, identifying *Elodea canadensis* (common waterweed) as dominant, with *Ceratophyllum demersum* (coontail) and *Lemna minor* (lesser duckweed) as sub-dominant. The 2005 survey not only collected information on frequency, density and dominance, but also used various established indices to assess the overall condition of the Easton Lake aquatic plant community.

Based on water clarity, chlorophyll and phosphorus data, Easton Lake is an eutrophic to mesotrophic seepage lake with fair to good water clarity and fair water quality. This trophic state should support fairly dense plant growth and frequent algal blooms. Sufficient nutrients, good water clarity, shallow lake, and soft sediments at Easton Lake favor plant growth. The aquatic plant community in Easton Lake is in the category of those very tolerant of disturbance, probably due to selection by a series of past disturbances. The plant community in Easton Lake is farther from an undisturbed condition than the average lake in Wisconsin overall and in the North Central Hardwood Region. In other words, the aquatic plant community in Easton Lake been impacted by an above average amount of disturbance and tolerates higher than average disturbance. Disturbances include invasions of exotic species, boat traffic, shoreline development, harvesting and past herbicide treatments.

Figure 35. Easton Lake Aquatic Plant Species, 2005

Scientific Name	Common Name	Type
Asclepias incarnata	Swamp Milkweed	Emergent
Carex spp	Sedges	Emergent
Ceratophyllum demersum	Coontail	Submergent
Elodea canadensis	Common Waterweed	Submergent
Eupatorium maculatum	Joe-Pye-Weed	Emergent
Impatiens capensis	Jewelweed	Emergent
Iris versicolor	Blue-Flag Iris	Emergent
Lemna minor	Small Duckweed	Floating
Myriophyllum sibiricum	Northern Milfoil	Submergent
Myriophyllum spicatum	Eurasian Watermilfoil	Submergent
Phalaris arundinacea	Reed Canarygrass	Emergent
Potamogeton crispus	Curly-Leaf Pondweed	Submergent
Potamogeton pectinatus	Sage Pondweed	Submergent
Potamogeton praelongus	White-Stem Pondweed	Submergent
Potamogeton zosteriformis	Flat-Stem Pondweed	Submergent
Ranunculus longirostris	Water Buttercup	Submergent
Ribes spp	Currant	Emergent
Sagittaria latifolia	Duck Potato	Emergent
Spirodela polyrhiza	Large Duckweed	Floating
Typha latifolia	Wide-Leaf Cattail	Emergent
Wolffia columbiana	Watermeal	Floating

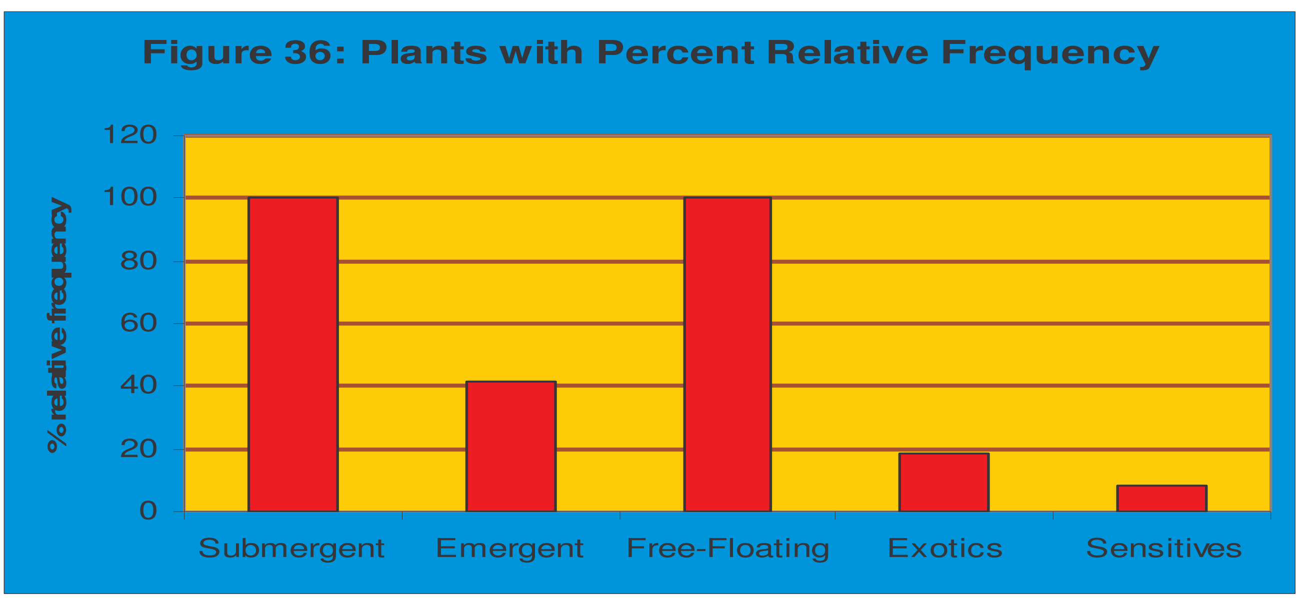
Of the 21 species found in Easton Lake, 18 were native and 3 were exotic invasives. In the native plant category, 8 were emergent, 3 were free-floating plants, and 7 were submergent types. Three exotic invasives, *Myriophyllum spicatum* (Eurasian Watermilfoil), *Phalaris arundinacea* (Reed Canarygrass) and *Potamogeton crispus* (Curly-Leaf Pondweed) were found.

Aquatic plants occurred at 100% of the sample sites in Easton Lake to a maximum rooting depth of 11'. Free-floating plants were found in all four depth zones. The 0-1.5 feet (Zone 1) depth zone produced the most frequently occurring plant growth, followed by the 1.5 feet-5 feet zone (Zone 2), then the 5 feet to 10 feet zone (Zone 3), and finally, the over 10 feet zone (Zone 4). The same order was followed with aquatic plant density. Both frequency and density then dropped off at depths over 5 feet, although plants were still found in those depths.

Wolffia columbiana was the densest and most frequently-occurring plant in Easton Lake in 2006 followed by *Elodea canadensis*, *Lemna minor* and *Ceratophyllum demersum.* No other species reached a frequency of 50% or greater. *Wolffia columbiana*, *Elodea canadensis* and *Lemna minor* occurred at more than average density overall in the lake in summer 2006.

Wolffia columbiana was also the dominant aquatic plant species in Easton Lake. Sub-dominant were *Lemna minor, Elodea canadensis*, and *Certatophyllum demersum,* in that order. *Myriophyllum spicatum, Potamogeton crispus* and *Phalaris arundinacea*, the exotics found Easton Lake, were not present in high frequency, high density or high dominance. It is possible that *Potamogeton crispus* is under-represented, since this survey was performed in August, somewhat later than its peak season. *Wolffia columbiana* was dominant in Depth Zone 1, with *Lemna minor* sub-dominant. *Elodea canadensis* dominated Depth Zone 2, with *Lemna minor* and *Wolffia columbiana* sub-dominant. *Wolffia Columbiana* was dominant in Depth Zone 3; *Elodea canadensis* and *Lemna minor* were sub-dominant. *Ceratophyllum demersum* and *Elodea canadensis* dominated Depth Zone 4.

The greatest number of species per site (species richness) was found in Zone 1 and Zone 3, each with 5.0 richness score. Zone 3 had the lowest species richness (4.9), followed closely by Zone 4 (5.0). Zone 4 had a species richness of 4.0, with Zone 2 had a species richness of 3.71.   Overall species richness was 4.5.



The Simpson's Diversity Index Easton Lake was .88, suggesting fair species diversity. A rating of 1.0 would mean that each plant in the lake was a different species (the most diversity achievable). This places it in the average range for Simpson's Diversity Index readings for both North Central Hardwood Forest and Wisconsin Lakes overall. The Aquatic Macrophyte Community Index (AMCI) for Easton Lake is 49. This is in the average range for North Central Wisconsin Hardwood Lakes and all Wisconsin lakes.

The presence of three invasive exotic species (Eurasian Watermilfoil, Reed Canarygrass and Curly-leaf Pondweed) and the lack of sensitive species are limiting the quality of Easton Lake. Currently, none of the exotic species appear to be taking over the aquatic plant community, perhaps due to the high density and occurrence of other native plants. However, these invasives should be monitored because their tenacity and ability to spread to large areas fairly quickly could make them a danger to the diversity of Easton Lake's current aquatic plant community.

Previously, a value was assigned to all plants known in Wisconsin to categorize their probability of occurring in an undisturbed habitat. This value is called the plant's Coefficient of Conservatism. A score of 0 indicates a native or alien opportunistic invasive plant. Plants with a value of 1 to 3 are widespread native plants. Values of 4 to 6 describe native plants found most commonly in early successional ecosystem. Plants scoring 6 to 8 are native plants found in stable climax conditions. Finally, plants with a value of 9 or 10 are native plants found in areas of high quality and are often endangered or threatened. In other words, the lower the numerical value a plant has, the more likely it is to be found in disturbed areas.

The Average Coefficient of Conservatism Easton Lake was 3.68. This puts it in the lowest quartile for Wisconsin Lakes (6.0) and for lakes in the North Central Hardwood Region (5.6). The Floristic Quality Index of the aquatic plant community in Easton Lake of 16.06 is below average for Wisconsin Lakes (22.2) and the North Central Hardwood Region (20.9). This is a further indication that the plant community in Easton Lake is farther from an undisturbed condition than the average lake in Wisconsin overall and in the North Central Hardwood Region.

Sediment composition can also affect plant growth, especially those that are rooted. The richness or sterility and texture of the sediment will determine the type and abundance of macrophyte species that can survive in a particular lake. Over 68% of the sediment in Easton Lake is soft with natural fertility and significant available water holding capacity. Although sand sediment may limit growth, all sandy sites in Easton Lake were vegetated. In fact, all sample sites were vegetated in Easton Lake, no matter what the sediment. The soft sediments, combined with the shallow depth allowing sunlight to penetrate to the entire bottom of the lake, promote dense plant and algal growth. Figure 37 shows the distribution of the different types of sediment in Easton Lake.

Figure 37: Sediments in Easton Lake

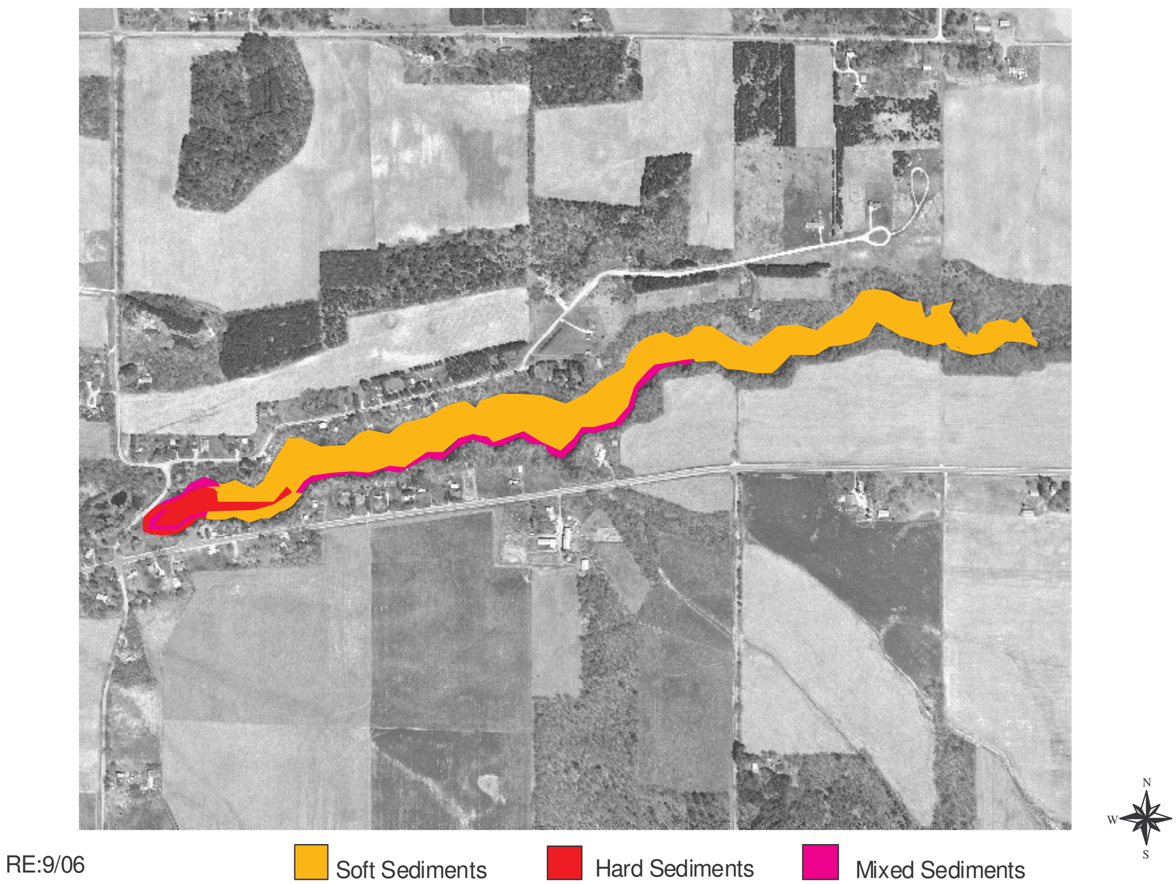
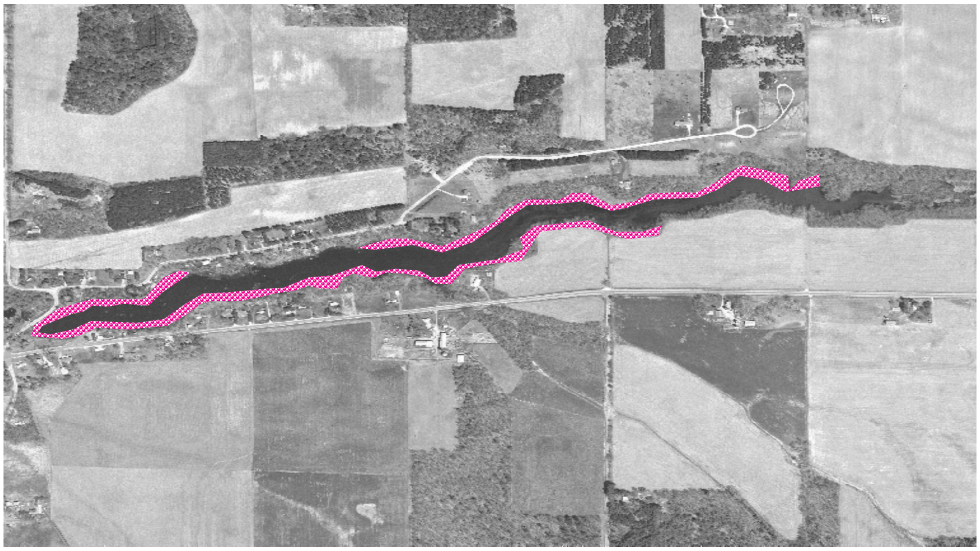


Figure 38a: Distribution of Emergent Plants 2006



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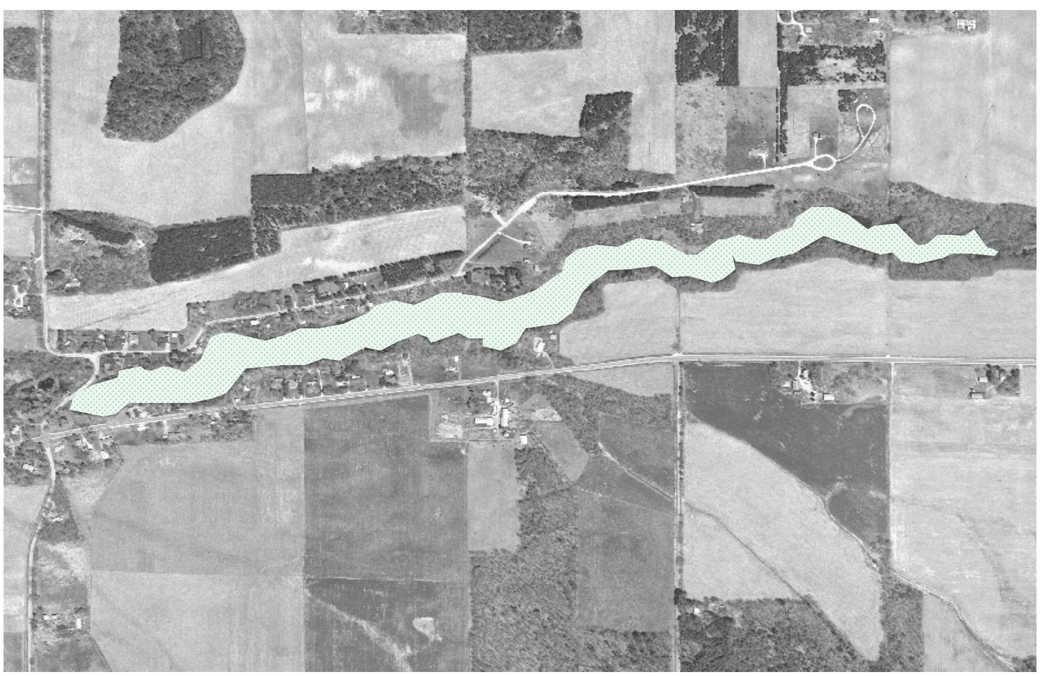
Emergent Plants Found 2006

Figure 38b: Distribution of Floating Plants 2006



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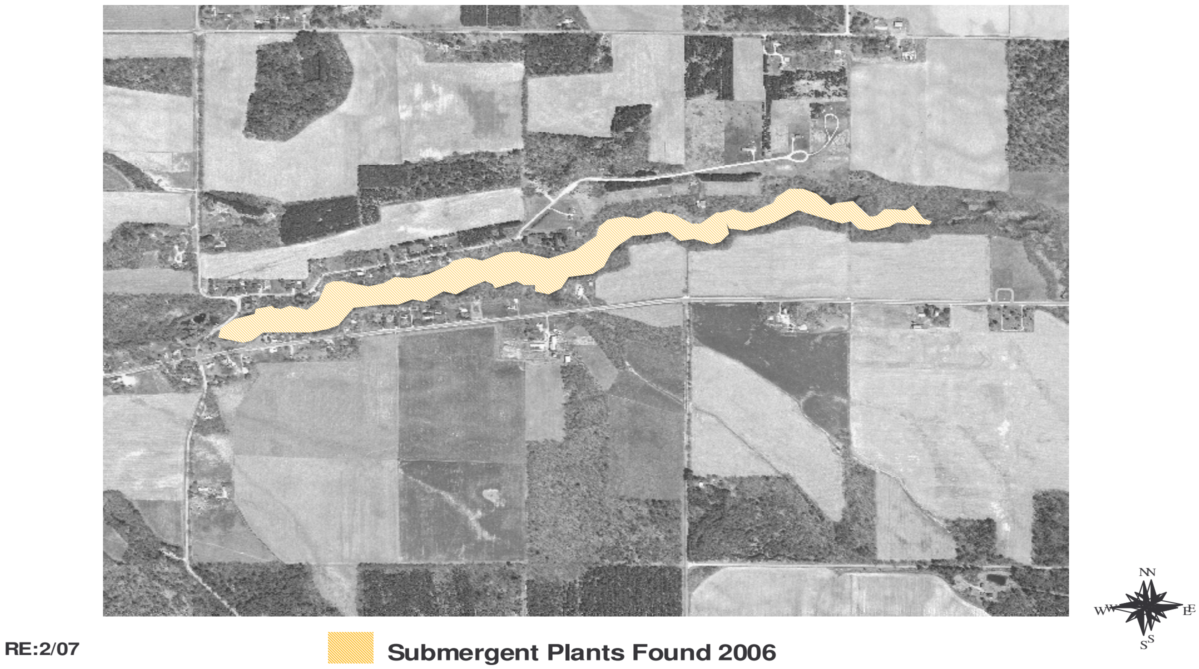
Free-Floating Plants Found 2006

Figure 38c: Distribution of Submergent Plants 2006



The most developed shore—that along the northside of the lake—has many "grandfathered" buildings that are close to the shore, suggesting that runoff from impervious surfaces such as decks or rooftops could be adding to the pollutant load in the lake. Installation of as much buffer (native) vegetation as possible between the buildings and the ordinary high water mark could filter pollutants and nutrients and help keep them out of the lake water.

Along the south shore, there is a large parking lot, County Road A and a supper club all very close to the lake, creating significant stormwater runoff and soil erosion potential. Installation of runoff diversion practices and some shore protection here would help protect water quality. There are areas of wooded and wetland shores on the southeast part of the lake that should be preserved as they are to maintain habitat and to serve as a buffer for that area. Studies have suggested that runoff from established wooded land is substantially less than that of developed areas.

Disturbed sites, such as those with cultivated lawn, hard structure, rock/riprap and pavement, were common on Easton Lake in 2006. Of vegetated shorelines, wooded vegetation had the most coverage. Some type of disturbed shoreline was found at over

71% of the sites. These conditions offer little protection for water quality and have significant potential to negatively impact Easton Lake's water by increased runoff (including lawn fertilizers, pet waste, pesticides) and shore erosion. Expanding the amount of vegetation and/or runoff catch at these shorelines would help prevent erosion and reduce runoff into the lake that contributes to algal growth, increased sedimentation, and reduced water quality.

An aquatic plant community evaluation was conducted on Easton Lake in 2001. Since the techniques used were different, comparing the results of the two evaluations should be done with caution. However, the results do suggest that there are some changes in the aquatic plant community. The results of the 2006 survey seem at first to suggest improvement that is evident in a higher Simpson's Diversity Index, higher Floristic Quality Index, higher AMCI score, higher species richness, and more species found. However, the average Coefficient of Conservatism has gone down, suggesting that even though there may be more species present, they are of types that tolerate more disturbance in the aquatic ecosystem, rather than high-quality plants. Further, the invasive *Myriophyllum spicatum* was not previously found in Easton Lake.

Based on frequency of occurrence, the aquatic plant communities of the two years are 76% similar. Based on relative frequency, they are 73% similar. Similarity percentages of 75% are considered statistically similar.

The most noticeable change between 2001 and 2006 is the addition of several emergent plants to the aquatic plant community. *Asclepias incarnata, Carex* spp*, Eupatorium maculatum, Impatiens capensis, Iris versicolor, Ribes spp,* and *Sagittaria latifolia* were not first identified as present in the 2006 survey. *Typha latifolia*, also an emergent plant, decreased in frequency of occurrence, as did *Ranunculus longirostris.*

Another change was the increased presence of free-floating plants: *Lemna minor* increased from 68.42% frequency to one of 73.66%; *Wolffia columbiana* went from 63.16% to 84.21%; and *Spirodela polyrhiza*, not found in 2001, had a frequency of 39.47%. An increased presence in these plant types can indicate an increased nutrient presence in the water column.

Figure 39: Table of Similarities & Differences

Easton	2001	2006	Change	%Change
Number of Species	12	21	9	75.0%
Maximum Rooting Depth	9.0	11.0	2	22.2%
% of Littoral Zone Unvegetated	0	0	0	0.0%
%Sites/Emergents	10.53%	13.16%	0.0	25.0%
%Sites/Free-floating	68.42%	86.84%	0.2	26.9%
%Sites/Submergents	94.74%	84.21%	-0.1	-11.1%
%Sites/Floating-leaf	0.00%	0.00%	0.0	0.0%
Simpson's Diversity Index	0.82	0.88	0.06	7.3%
Species Richness	3.63	4.50	0.87	24.0%
Floristic Quality	15.01	16.06	1.05	7.0%
Average Coefficient of Conservatism	4.33	3.68	-0.65	-15.0%
AMCI Index	43	49	6.00	14.0%

Of submergent plants, both *Ceratophyllum demersum* and *Elodea canadensis* decreased in frequency of occurrence. *Potamogeton pusillus* and *Vallisneria americana*, found in 2001, were not found in 2006. *Potamogeton praelongus*, a more sensitive plant than *Potamogeton. pusillus* and *Vallisneria americana*, was found at Easton Lake for the first time in 2006. *Potamogeton zosteriformis* increased in frequency. Two submergent plants, *Myriophyllum sibiricum* and *Potamogeton pectinatus*, remained the same in frequency.

Unfortunately, another change is that two invasive exotics, *Myriophyllum spicatum* and *Phalaris arundinacea* were found in 2006 and had not been previously reported in Easton Lake. Further, the frequency of another exotic, *Potamogeton crispus*, increased from 5.26% *to* 13.16%, even though the 2006 survey was conducted after peak season for that plant.

Recommendations from the 2006 Aquatic Plant Survey were:

(1) Because the plant cover in the littoral zone of Easton Lake is over the ideal (25%-85%) coverage for balanced fishery, consideration should be given to reducing plant growth in at least some areas. A map of areas to have plants removed should be developed, then removal should occur by hand in shallow areas to be sure that entire plants are removed and to minimize the amount of disturbance to the settlement.

(2) Natural shoreline restoration in some areas is needed. Disturbed shorelines cover too much of the current shoreline, especially with many buildings less than 50' from the ordinary high water mark. A buffer area of native plants should be restored around the lake, especially on those sites that now have traditional lawns mowed to the water's edge or buildings very close to the water's edge. Stormwater management of these impervious surfaces is essential to maintain the high quality of the lake water.

(3) No lawn chemicals, especially lawn chemicals with phosphorus, should be used on properties around the lake. If they must be used, they should be used no closer than 50 feet to the shore.

(4) An aquatic plant management plan should be developed with a regular schedule of activities. Such plans will be required by the Wisconsin DNR for aquatic plant permits and grants and will also assist in reducing the frequency and density of the plants in Easton Lake. Mechanical harvesting should be used to provide navigation lanes in deeper water.

(5) The schedule should include target harvesting for Eurasian Watermilfoil (EWM) to prevent further spread.

(6) The Easton Lake Association may want to apply for grants from the Wisconsin Department of Natural Resources to help defray the cost of aquatic plant management.

(7) No broad-scale chemical treatments of aquatic plant growth are recommended due to the undesirable side-effects of such treatments, including increased nutrients from decaying plant material and decreased dissolved oxygen and opening up more areas to the invasion of EWM.

(8) Fallen trees should be left at the shoreline.

(9) Although Adams County Land & Water Conservatism Department currently takes regular surface water samples, the program only goes through 2006. Easton Lake residents should resume monitoring through the Wisconsin Self-Help Monitoring Program to permit on-going monitoring of the lake trends for basically no cost. This monitoring will be delayed until the lake is restored to its ordinary high water mark in 2 to 3 years.

(10) Easton Lake residents should identify, cooperate with and participate in watershed programs that will reduce nutrient and sediment inputs.

(11) Sensitive vegetation, emergent vegetation and lily pad beds should be protected where they are currently present. These not only provide habitat, but also help stabilize the sandy shores.

(12) The areas where there is undisturbed wooded shore should be maintained and left undisturbed.

(13) The Easton Lake District should make sure that its lake management plan takes into account all inputs from both the surface and ground watersheds and addresses the concerns of this lake community.

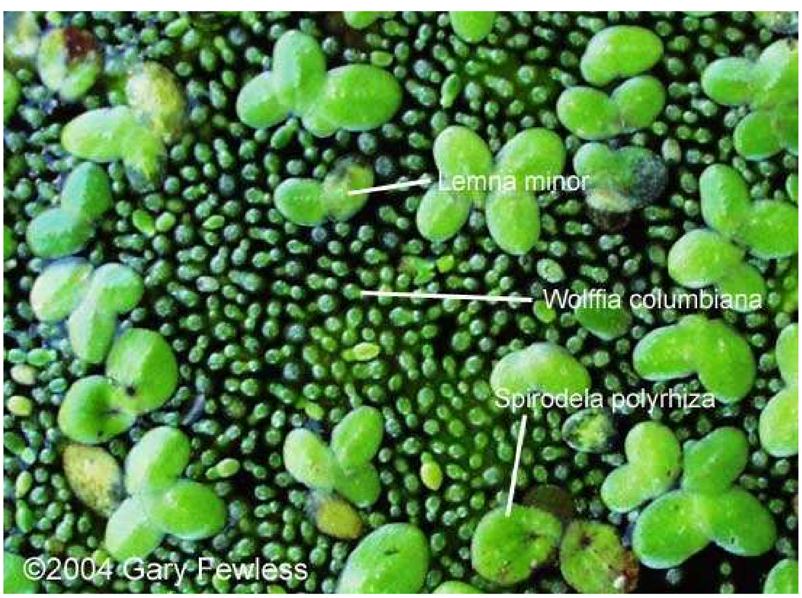
Ceratophyllum demersum
(Coontail)

Figure 40: Most Abundant Native Aquatic Species in Easton Lake

Elodea canadensis
(Common Waterweed)

Lemna minor
(Small Duckweed)

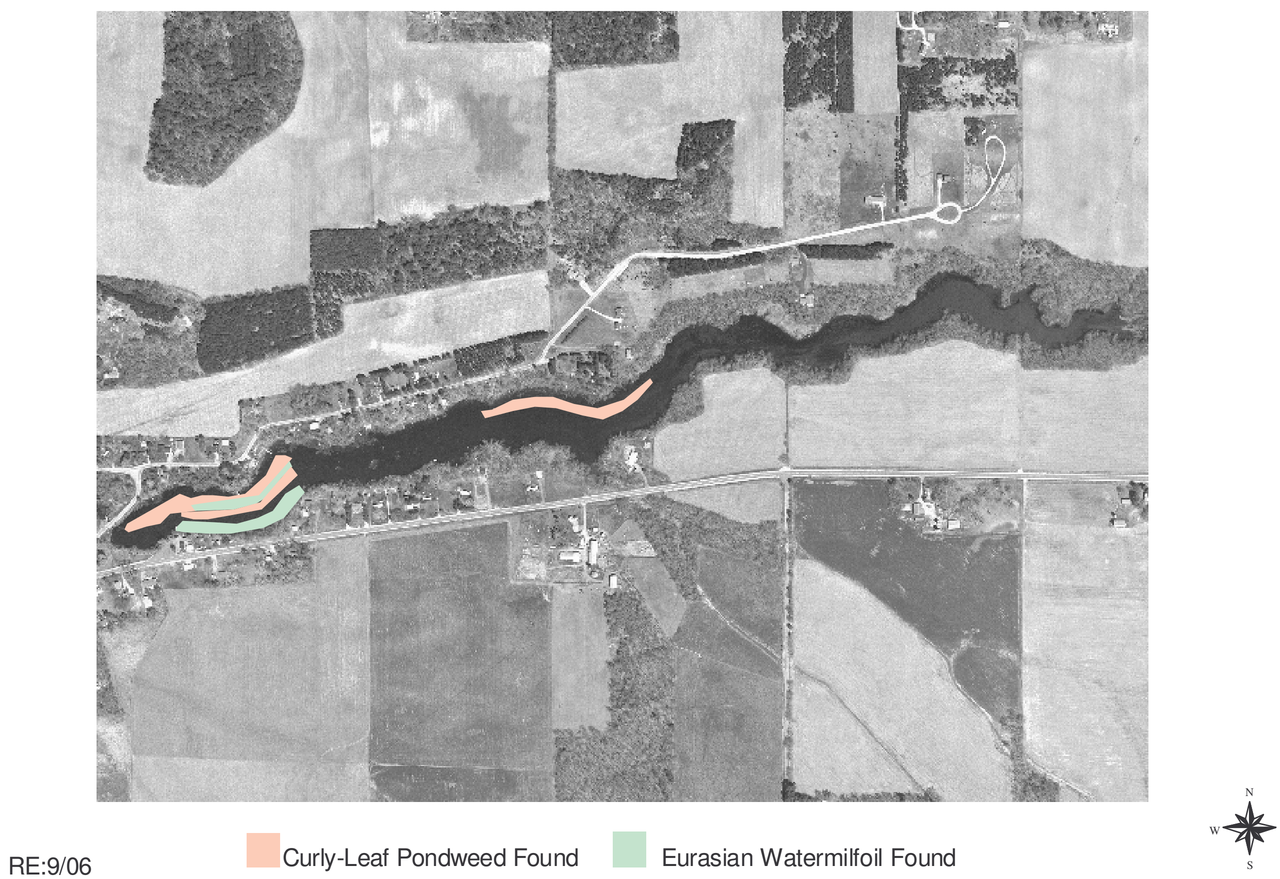
Wolffia columbiana
(Common Watermeal)



Aquatic Invasives

Easton Lake has three known invasive aquatic species: Curly-Leaf Pondweed (submergent), Reed Canarygrass (emergent) and Eurasian Watermilfoil (submergent). The Easton Lake District has a lake management plan that includes management of aquatic invasives. The lake has been using harvesting as its main control of aquatic species, including the invasive ones. Originally, it was planned that lake citizens would be trained in 2008 to monitor the aquatic invasives and participate in the Clean Boats, Clean Waters boater education program. Although the training may still occur, the monitoring and boater education programs won't be able to start until the lake is restored to its ordinary high water mark in two or three years.

Figure 41: Distribution of Exotic Aquatic Plants in 2006



Myriophyllum spicatum
(Eurasian Watermilfoil)

Potamogeton crispus
(Curly-Leaf Pondweed)

Figure 42: Aquatic Invasives Aquatic Plants in Easton Lake

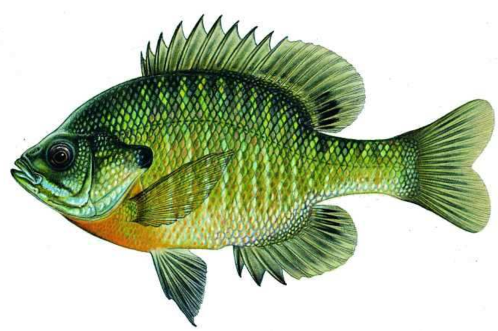
Phalaris arundinacea
(Reeed Canarygrass)

FISHERY/WILDLIFE/ENDANGERED RESOURCES

A 1954 fishery inventory of Easton Lake found that brown trout, white suckers, golden shiners and bullheads were scarce in the lake, but bluegill and black crappie were abundant or common. A few northern pike were also found. An inventory in the 1960s found the same kind of fish, plus pumpkinseeds and blacknose shiners. Stocking of bullheads was done in the 1930s and 1940s. Reviews found on Lake-Link (online) in 2001 and 2005 described the lake as having "monster bass" and "huge panfish".

Muskrat are also known to use Easton Lake shores for cover, reproduction and feeding. Seen during the field survey were various types of waterfowl and songbirds. Frogs and salamanders are known, using the lake shores for shelter/cover, nesting and feeding. Turtles and snakes also use this area for cover or shelter in this area, as well as nested and fed in this area. Upland wildlife feed and nest here as well.

Largemouth Bass



Bluegill

Pumpkinseed

Figure 43: Some of the common fish in Easton Lake

The Easton Lake watersheds have several endangered natural communities, as well as plants and a lizard of concern. Natural communities found there include Alder Thicket, Calcareous Fen, Dry Prairie, Northern Sedge Meadow, Northern Wet Forest, Shrub-Carr and Stream (hard, fast, cold). The amphibian of concern is the Western Slender Glass Lizard (*Ophisaurus attenuatus*). Special plants found include Bushy Aster (*Aster dumosus*), Early Anemone (*Anemone nemorsa*), Hairy Beardstongue *(Penstemon hirsutus*) and Hooker's Orchid *(Plantanthera hookeri*).

Early Anemone

Exhibit 44: Some of the Endangered Resources in Easton Lake Watersheds

Hooker's Orchid

Western Slender Glass Lizard

*information courtesy of Wisconsin Department of Natural Resources

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